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MAY, 1842.

Civil Engineering.

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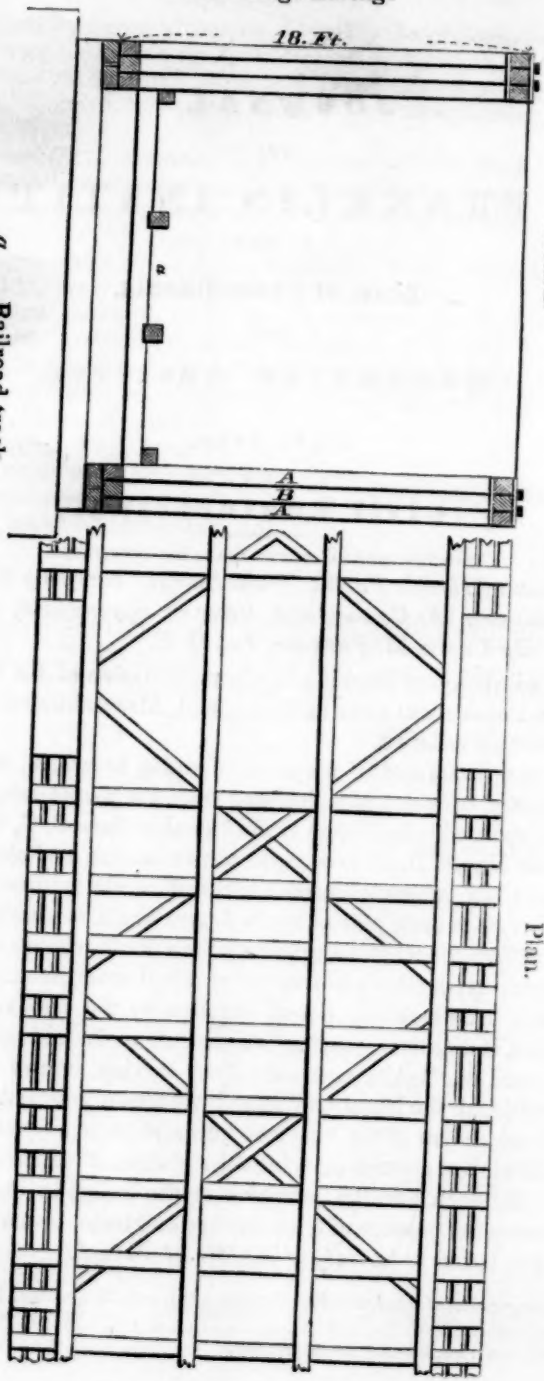
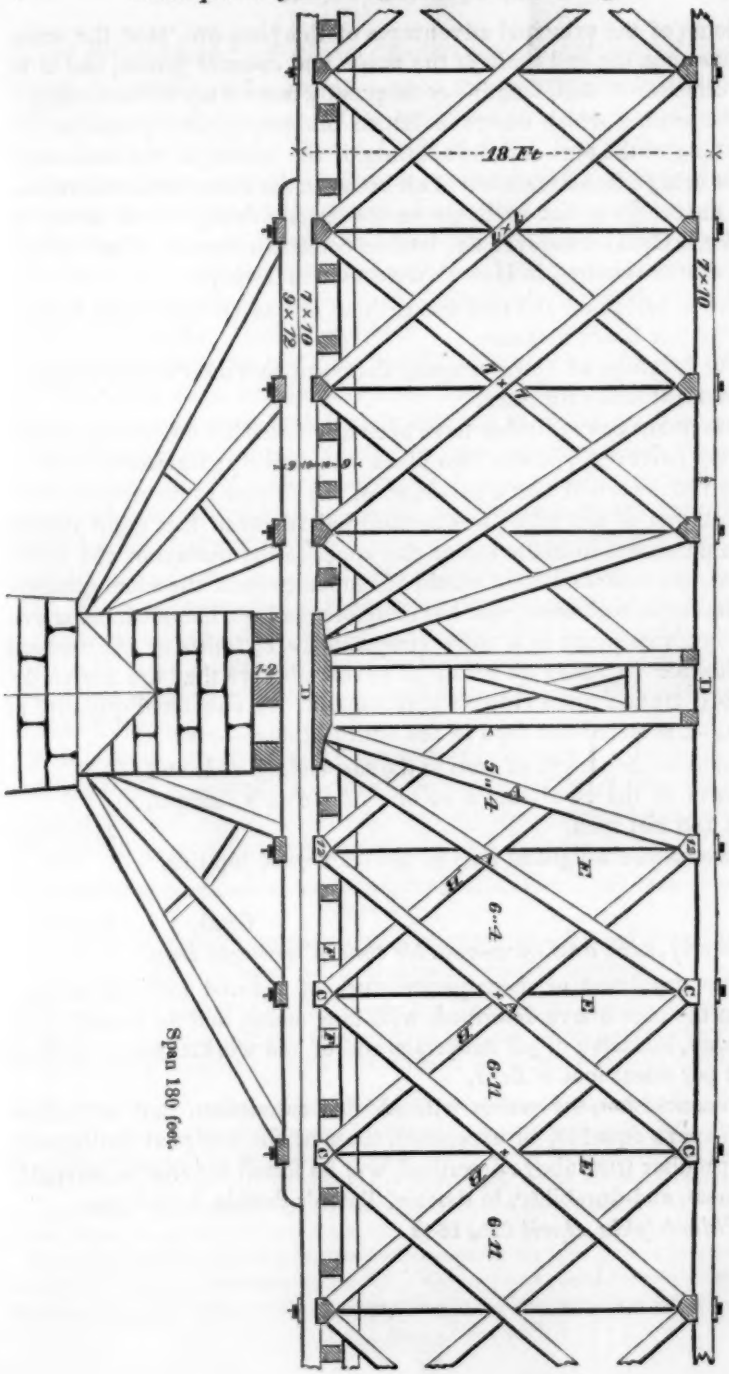
Description of Howe's Patent Truss Bridge, carrying the Western Railroad over the Connecticut River at Springfield, Massachusetts. By* LEWIS M. PREVOST, JR., *C. E.*

The accompanying drawing is a representation of the bridge built across the Connecticut river at Springfield, Massachusetts, on the line of the Western railroad.

Each truss is formed of a system of *main braces*, A, A, A, seven inches square, of white pine, inclined from the piers towards the centre of the span, abutting upon *white oak shoulders*, C, C, C, which are let into the *chords* D, D, to a depth of two inches; and *counter braces* B, B, B, of the same dimensions, inclined in the contrary direction, passing between each pair of *main braces* and also abutting upon the *white oak shoulders*. The upper and lower *chords* are composed of planks, forming, in all, six horizontal beams of seven by ten inches each. The whole truss is firmly bound together by the *iron rods* E, E, E, two inches in diameter, passing between the *main* and *counter* braces, and through the *white oak shoulders;* having screws cut on their lower ends, and the lengths adjusted by means of burrs; these suspending rods act in lieu of the king and queen posts usually employed, and sustain the lower chords, on which the girders, F, repose. The spans are 180 feet each, and the deflection of the bridge in the middle of a span, during the passage of a locomotive and train, by careful measurement, was found to be *only a quarter of an inch!*

* See the number of this Journal for October, 1841, page 250, where a brief abstract of the patent is given.


18. Ft.
a
A
B
A
a Railroad track.
Section.
Plan.


18 Ft.
7×10
7×10
9×12
7×7
9 9 9
1-2
D
D
5" Ø
A
E
H
6-4
E
H
6-11
E
H
6-11
Span 180 feet.

Elevation.

Some of the principal advantages of this plan are, that the stress comes upon the end grain of the *main* and *counter braces*, and is in the direction of their length—consequently there is not the same danger of the settling which occurs in lattice bridges, in consequence of the crushing of the pins and the splitting of the lattices at the ends—and there being a free circulation of air between the *main* and *counter braces*, the bridge is not so liable to the speedy decay which occurs in lattice bridges, wherever the lattices come in contact. There is also less timber required in Howe's truss than in Town's.

For a bridge of 180 feet span, there are in Howe's truss frames, 28,636 feet board measure.

For a bridge of 180 feet span, there are in Town's double lattice, 46,080 feet board measure.

These quantities of timber have been calculated for the trusses, or sustaining parts only, of the two plans respectively; supposing each to span 180 feet, and the truss depth of the former to be eighteen feet, whilst that of the latter was assumed at nineteen feet eight inches, both measured from the top of the upper to the bottom of the lower chord: the roof and floor would of course contain the same quantity of timber in both cases, and has therefore not been included, being evidently unnecessary in a *mere comparative estimate of the amount of lumber in each;* we must, however, observe that the above described trusses upon Howe's plan, contain the subjoined quantity of iron,—a material not used in the lattice bridges—viz:

Approximate weight of iron in the suspending rods and burrs of the two trusses of one of Howe's bridges, of 180 feet span,	21,100 lbs.
Approximate weight of iron in the transverse top ties,	710
Total,	21,810

Or nearly, *nine and three-quarter tons of wrought iron.*

The usual cost of the superstructure of covered railroad bridges, upon the plan above described, with long spans, and for a single track railway, inclusive of all materials, and of the workmanship, is about $ 22 per lineal foot of floor.

In conclusion, the writer will add his conviction, that in bridges with spans equal to, or exceeding, those of the bridge at Springfield, the peculiar truss above described, will be found superior in strength, stiffness, and durability, to those of Town's double lattice plan.

Philadelphia, April 6th, 1842.

Use of Bituminous Cements in Europe, and in the United States.

Some time since, a document came to the Institute, under the frank of the Department of War, and for which we presume, we are indebted to the kindness of Col. Totten, Chief of the U. S. Engineers.

This document is entitled "Papers on practical Engineering, published by the Engineer Department, for the use of the officers of the United States corps of Engineers," and consists of a valuable essay on "Bitumen, its varieties, properties, and uses. Compiled from various sources by Lieut. H. W. Halleck, U. S. Engineer, under the direction of Col. J. S. Totten, Chief Engineer."

We extract from this essay the last chapter, (XII) which exhibits in an abbreviated form, some of the most important results of the experience which has now been had in the use of Bituminous mastics, both in Europe and in this country; it was our first design to have given a synopsis of the entire document, but on perusing it, we found that the chapter referred to, contained such a summary of the practice detailed in the body of the work, as in a great degree to supersede the necessity of any other condensation of the subject matter.

To this extract we shall subjoin some remarks upon Coyle's resinous cement, its properties, and cost, as developed in an experiment, made with it on a tolerably large scale, in forming a floor over the arch of the Licking Aqueduct on the Chesapeake and Ohio Canal, to prevent filtrations.

This cement, which is a factitious mastic, having for its basis the common rosin of commerce,—was here applied by Mr. Coyle, the patentee,* in person, under the general supervision of one of the Collaborators for the Engineering department of this Journal.

Extract from "Papers on Practical Engineering," published by the United States Engineer Department.

Cost, specific gravity, proportions of ingredients, &c., of the Mastic used upon several Bituminous Works in Europe.

The proportions of the ingredients for bituminous mastic, as recommended by the authorities referred to in the preceding pages, are very far from being uniform. And this want of uniformity is not altogether

* The *exclusive* right of Mr. Coyle, to apply the resinous cement, in such situations as this, would certainly never stand the test of a forensic discussion; as may be inferred by examining an extract from his patent, in the number of this Journal for June, 1838, where the claim is expressly stated to be, "*the applying it* (in places, or vessels, *which contain water*) so highly heated as that it shall expel the moisture therefrom, so as effectually to adhere to pebbles, stones, wood, and other substances, with which it comes into contact."

Now as the Aqueduct referred to, did not *contain water* at the time of the application of the cement, it was not a case within the purview of Coyle's patent; neither was the use which was made of it at the Treasury building, as mentioned in the latter part of our extract.

due to the difference in the quality of the bitumens used, for the proportions are made to vary considerably, by different persons, where precisely the same materials are employed. Further experiments and analyses are necessary to form definite rules. And we can see no reason why rules may not be as readily determined for the mastics, as for the mortars and hydraulic cements, provided we resort to a chemical analysis of the materials, and a strict examination of the strength, hardness, elasticity, specific gravity, &c., of the resulting mastics. We here give a summary of the proportions of ingredients, cost of labor, and other data from several bituminous works, in hopes that they may serve as a basis for further investigations. The following analyses of several of the bituminous minerals, by M. P. Berthier,* may also be of use in comparing the results obtained from different mastics. It was noticed too late to be inserted in a more appropriate place.

Bitumen of Seyssel.—Of the bituminous minerals of Seyssel, there are three kinds. 1. A sandy mineral. 2. A very fusible calcareous mineral. 3. A calcareous mineral of difficult fusion.

The first of these melts in boiling water, and becomes detached from the stony matters to which it was adherent. It rises to the surface, or sticks to the sides of the vessel in brown lumps, or forms a transparent coating of a brownish red color. A rich specimen of it gave—

Bituminous oil,	.086	Bitumen, .106
Carbon,	.020	
Quartzy grains,	.690	
Calcareous grains,	.204	
	1.000	

In the mass it is much less rich. When purified by hot water, this bitumen is called *la graisse.*

The second variety is at Seyssel called *asphaltum.* It may be pulverized and sifted, but the powder spontaneously forms into balls. The specimen analyzed contained .11 of bitumen, 5.89 of carbonate of lime, without clay, and quite pure. The mastic of Seyssel is prepared by mixing nine parts of this asphaltum with one of the mineral tar *(la graisse)* extracted from the sand.

The third variety is a compact limestone, in extremely thin, parallel beds. It consists of—

Bituminous matter,	.100
Argile,	.020
Sulphate of lime,	.012
Carbonate of lime,	.868
	1.000

Bitumen of Belley.—This bituminous mineral is very similar to the preceding. It is found in several communes in very considerable quantities, near the surface of the ground. It is of a variable quality. A specimen yielded—

* Annales des Mines, tom. 13, liv. 3.

Carbonate of lime,	.824
Carbonate of Magnesia,	.020
Sulphate of lime,	.013
Argile,	.023
Bitumen,	.120
	1.000

Bitumen of Bastenne.—This bitumen flows out from several openings, or springs, mixed with water. An analysis of the solid variety gave:—

Oily matter,	.200	Bitumen, .237
Carbon,	.037	
Fine quartzy sand, mixed with argile,	.763	
	1.000	

Bitumen of Cuba.—This is transported to Europe under the name of Mexican asphalt, or chapopote. It is a solid bitumen, which exists in abundance near Havana. It may be used with great advantage in paving. It consists of at least two different substances, the one soluble and the other insoluble in ether and the spirits of turpentine. It is the relative proportion of these two substances which imparts to the different bitumens their peculiar properties.

Bitumen of Monastier. (Haute Loire.)—This does not soften in the least in boiling water, and hence cannot be extracted, by any simple means, in large quantities. It contains—

Bituminous oil,	.070	Bitumen, .105
Carbon,	.035	
Water,	.045	
Gas and vapors,	.040	
Quartz and mica,	.600	
Ferruginous argile,	.210	
	1.000	

The bitumen of Haute Loire differs essentially from those of Seyssel and Bastenne, by its insolubility in boiling water, and its solubility in alcohol.

The following is the quantity of material per square yard of bituminous covering, as given in the "Manuel pour l'Application de l'Asphalte du Val-de-Travers."

For one square yard of bituminous mastic paving, at a thickness of $\frac{48}{100}$ of an inch, there will be required—

33.10 pounds of the asphaltic mastic.
18.39 pounds of fine gravel.
0.62 pounds of mineral tar.

Or the following proportions may be used:—

36.78 pounds of the asphaltic stone.
2.84 pounds of mineral tar.
18.39 pounds of fine gravel.

For one square yard of ordinary bituminous covering, at a thickness of $\frac{4}{10}$ of an inch, there will be required—

40.46 pounds of pure mastic.

For one square yard of stable paving of the bituminous mastic, at a thickness of $\frac{72}{100}$ of an inch, there will be required—

From 40.46 to 44.14 lbs. of the asphaltic stone.
36.78 pounds of gravel.
2.68 pounds of mineral tar.

Specific gravity of the mastic made from the asphaltic stone of the Val-de-Travers—

One cubic foot weighs, - - -	140.99	lbs.
One square yard, $\frac{4}{10}$ of an inch thick, -	41.62	"
One square foot, $\frac{1}{12}$ of an inch thick, -	1.10	"

The specific gravity of the mastic of Parc, is 140.72 pounds, per cubic foot, which differs but very little from the preceding.

This last mastic, at the manufactories, costs, $2.25 per 100 lbs.

A covering of this mastic, $\frac{4}{10}$ of an inch thick, costs $1.01 per square yard.

The weight of the different kinds of asphaltic coverings recommended in the manual of the Seyssel Company, is as follows:—

First: A square yard of the bituminous covering applied upon cloth, the surface being first spread over with gravel, and the whole resting on a bed of mortar of a mean thickness of one and a half inches:—

For the mastic, - - - - - -	45.9	lbs.
" " bed, - - - - - - -	110.3	"
Total,	156.2	"

Second: The mastic, cloth, and gravel, for one sq. yd.,	45.9	lbs.
The tile, $1\frac{2}{10}$ inches thick, the mortar included,	73.6	"
Total,	119.5	"

Third: The mastic, cloth, and gravel, per square yard,	45.9	lbs.
The tile, $\frac{5}{10}$ of an inch thick, laid dry,	55.1	"
Total,	101.0	"

Fourth: The mastic, cloth, and gravel, per square yard,	45.9	lbs.
The tile, $1\frac{9}{10}$ inches thick,	82.7	"
Total,	128.6	"

Fifth: The mastic, cloth, and gravel, per square yard,	44.1	lbs.
The tarred paper,	3.6	"
Total,	47.7	"

The manual of the Val-de-Travers Company gives four and a half or five per cent. as the proportion of mineral tar to be used for flag-

ging sidewalks, vestibules, &c.; and seven and a half or eight per cent. for paving stables, courts, and works of that character. If the mastic be used for stables, the gravel should be full one half the whole mass. Mixture given for McAdamized roads, one-third coal tar, one-third pulverized asphaltic stone, and one-third fine sand. For pointing wooden pavements, the mastic is composed of eighty-five or ninety parts of asphaltic stone, five of mineral tar, and five or ten of fine sand.

Captain André used, at New Brisack, for covering the planking of a draw-bridge, one part by weight, of Lobsann mastic, and seven parts by weight of mineral tar. Cost of this covering per square yard, $0.12.

Another mixture used for the same purpose, one part of Lobsann mastic, one and a half part of mineral tar. Cost per square yard $0.14.

Captain Chauvet used for pointing masonry at New Brisack a mixture of ten parts of Lobsann mastic, and nearly one part of mineral tar. The joints were $4\frac{72}{100}$ inches deep, and one-fifth of an inch wide. Cost of this pointing per foot running measure, $0.3¾.

Major Tomassin used for pointing masonry, at New Brisack, six parts of Lobsann mastic to one part of mineral tar. The joints were but $\frac{59}{100}$ of an inch deep, and $\frac{74}{100}$ of an inch wide. Cost of this pointing, per foot, $18\frac{7}{100}$ cents.

For pointing and rough casting masonry at Schelestadt, Captain Duché used thirty parts of Lobsann mastic to one part of mineral tar. Cost of this, per square yard, $0.77.

The same officer at Strasbourg, and for the same purpose, used two parts of Lobsann mastic, and one part of mineral tar.

For coating masonry, at Valenciennes, M. Huz used a mixture of—

220 pounds of bituminous mastic,
110 " of linseed oil,
6½ " of litharge,
26½ " of spirits of turpentine, and
6 cakes of Spanish white.

Cost of a covering of this mixture, per square yard, $0.12.

M. le Blanc gives the following proportions for an artificial bituminous mastic:—

18 parts of pitch *(brai sec,)*
18 " mineral tar,
6 " slacked lime,
60 " sand,
30 " fine gravel.

If chalk be used, the following are the proportions:—

1 part of mineral tar,
1 " pitch,
7 " chalk,
2 " sand,

The cost of a covering of M. le Blanc's artificial bituminous mastic, $\frac{6}{10}$ of an inch thick, per square yard, is—

For materials, about - - - - -	$0.12½
For workmanship, - - - - - -	0.24
For fuel, utensils, &c., - - - - -	0.03½
Total cost,	$0.40

M. Partiot gives the first cost of the ordinary pavements of Paris, per square yard, $1.25.

First cost of bituminous pavements of Paris, per square yard, $1.42.

First cost of paving blocks, six inches thick, composed of fragments of stone and bituminous mastic, per square yard, $1.27.

First cost of a pavement of an artificial bituminous mastic, $\frac{6}{10}$ of an inch thick, built on a brick foundation laid in hydraulic mortar, per square yard, $1.01.

First cost of a natural bituminous pavement, of the same thickness, and of the same kind of foundation, $1.39.

First cost of granite paving, $3.32.

First cost of Lava paving $2\frac{4}{10}$ inches thick, $2.24.

The composition used in forming a floor in Assomption Barracks, Paris, for one square yard, half inch thick, was made of—

Sand, - - - - -	21.33 pounds.
Mastic, - - - - -	39.24 "
Mineral tar, - - -	0.62 "

The composition used in covering casemates at Vincennes, for one square yard, half inch thick, was made of—

Sand, - - - - -	21.19 pounds.
Mastic, - - - - -	38.88 "
Mineral tar, - - -	0.52 "

The amount of coal required as fuel, to prepare the mastic for covering one square yard, is estimated by M. Perrin, at 10.87 pounds, and the amount of labor $\frac{7}{100}$ of a day's work. He allows $\frac{1}{10}$ of the cost for the use of utensils, and profit of contractors.

The proportions given in the manual of the Seyssel company for forming a mastic to be used on the caps of arches are:—

Powdered asphaltic stone, - - -	92 parts.
Mineral tar, - - - - - - -	8 "

If the mastic is to be used for roofs:—

Powdered asphaltic stone, - - -	93 parts.
Mineral tar, - - - - - - -	7 "

If it is to be used for flagging:—

Powdered asphaltic stone, - - -	60 parts.
Mineral tar, - - - - - - -	7 "
Gravel, - - - - - - - -	33 "

The following table of prices of Seyssel mastic is published by "Coignet & Cie., Paris. Rue du Bac, 83:"—

Area of from—	Covering for Sidewalks.		Covering for Terraces.		Foundations.	
					Of Concrete.	Of Brick.
1 to 2 sq. yds.	$3.17	pr. sq. yd.	$3.49	pr. sq. yd.		
1 to 3 "	2.14	"	2.46	"		
3 to 4 "	1.90	"	2.38	"		
4 to 5 "	1.66	"	1.98	"		
5 to 6 "	1.58	"	1.90	"	$0.48	$0.55
6 to 7 "	1.50	"	1.82	"		
7 to 8 "	1.42	"	1.74	"		
8 to 9 "	1.34	"	1.66	"		
9 to10 "	1.26	"	1.58	"		
10 to 50 "	1.18	"	1.50	"		
50 to 200 "	1.10	"	1.42	"	0.39	0.48
200 to 500 "	1.02	"	1.34	"		
500 and above	0.94	"	1.26	"	0.31	0.39

At a thickness of 0.48 of an inch.

At a thickness of 0.40 of an inch.

Pointing of flagging, $0.18 per linear yard.
"Solins," 0.21 " "

Asphaltic stone, eight and a half francs ($1.59,) per 100 kilm's. (220½ lbs.,) delivered at Marseilles.

Mineral tar, forty francs ($7.48,) per 100 kilm's. (220½ lbs.,) delivered at Marseilles.

Asphaltic mastic, fifteen francs ($2.80,) per 100 kilm's. (220½ lbs.,) delivered at Marseilles.

The following prices (from "Essay on Bitumen," London, 1839) for constructing bituminous pavements, &c., in London and the immediate vicinity, are those given in the advertisements of the Bastenne company, in the year 1839.

PRICES.*

First.—For the Materials.

Pure mineral tar, - - -	$6.16	per cwt.
Mastic, - - - - -	2.20	"

Second.—For the Construction of Works.

The Paving of Sidewalks.

From	50	to	100	square feet, $0.27½	pr. sq. foot.
"	100	to	250	" 0.24	"
"	250	to	500	" 0.20	"
"	500	to	750	" 0.18	"
"	750	to	1000	" 0.16	"
"	1000	to	2000	" 0.14	"
"	2000	to	5000	" 0.12	"

* In changing the denomination of these prices from the English to our own coins, the shilling is taken at twenty-two cents, its usual current value in the United States.

Covering of Roofs and Terraces.

From	50	to	100	square feet,	$0.32 pr. sq. foot.
"	100	to	250	"	0.29 "
"	250	to	500	"	0.23 "
"	500	to	750	"	0.22 "
"	750	to	1000	"	0.20 "
"	1000	to	2000	"	0.18 "
"	2000	to	5000	"	0.16 "

Pointing.

For filling up joints of brick-work, &c., the price will vary from one and four-fifths cents to two and one-fifth cents per foot, running measure, according to the quantity of mastic used.

These prices are calculated for a thickness of half an inch.

The following from Silliman's Journal—(Vol. xxxiv, No. 2,) are the retail prices, as charged by the Seyssel Company in Paris, for furnishing the raw materials, or executing bituminous works:—

Asphaltic stone in its native state,	$2.08 per 100 lb.
For constructing foot pavements, &c., &c.,	1.28 per sq. yd.
For covering roofs, &c.,	1.65 "

From the same work we find the following prices: For Yorkshire stone paving, where small sized flagging stones were used—

	Tooled.	Rubbed.
For three inch paving, per square foot,	$0.16	$0.21
For four inch paving, per square foot,	0.22	0.26

Where larger stones are required, for the more traveled thoroughfares, the prices are as follows:—

	Tooled.	Rubbed.
For four inch stone, per square foot,	$0.36	$0.44
For five inch stone,	0.44	0.52
For six inch stone,	0.62	0.70

The "Civil Engineer's and Architect's Journal," page 419, gives the Belgium prices for making sidewalks of Lobsann mastic, as follows:—

Any area under 30 yards,	$1.02 per yd.	for plain work.
	1.09 "	lozenged.
Any other quantity,	0.95 "	for plain work.
	1.02 "	lozenged.

Use of Bituminous Mastic in the United States.

Although we have several varieties of bitumen in different parts of this country, and in some localities large quantities of it, but little attention has heretofore been given to its use; and even in the few instances in which it has been employed as a building material, no proper record of the details and results has been made or published. Considerable quantities of the foreign bitumens have been imported and used in our large cities for sidewalks, floors, roofs, &c., but they have sometimes failed to give satisfaction, through ignorance of the

proper mode of making and applying the mastic. Wherever the proper directions have been followed, the success has been complete. It is hoped that the experiments which are now being made upon our public works, will soon furnish some valuable facts to be added to the following scanty record.

Major John L. Smith, of the United States Corps of Engineers, procured for the public works in New York, in the fall of 1839—

Asphaltic stone at - - -	$1.13	per 100 lbs.
Bastenne tar, - - -	4.76	"
Use of kettles and other utensils, -	0.30	per day.
Services of an "applicateur," -	1.50	"

The same officer purchased in New York, from the agents of the Val-de-Travers Asphaltic Company—

Asphaltic stone at - - -	$1.20	per 100 lbs.
Bastenne tar, - - - - -	5.25	"

In March, 1841, in consequence of the above company stopping operations,* Major Smith purchased of the agents in New York, Messrs. Thirion & Millard, their whole stock of Bastenne tar, consisting of twenty-nine casks, each containing about six hundred pounds, at the reduced price of $3.93 per one hundred pounds; and the requisite amount of asphaltic stone to be used with this tar in forming mastic, at $0.90 per one hundred pounds. The remainder of their stock of asphaltic stone, for which they had no mineral tar, was offered at $0.81 per hundred pounds.

The "applicateur" employed at Fort Schuyler recommended that the above materials be used in the proportion of *thirteen* pounds of the asphaltic stone to *one* pound of the mineral tar. In one of the experiments made at that fort, the mastic was formed of 11½ pounds of the stone to one of tar. These proportions differ but slightly from those given in the manual of the Val-de-Travers Company for making mastic of the same materials. The experiments of Major Smith were completely successful. The casemates that have been covered with the mastic remain perfectly water-tight, and to this date no alteration can be perceived in the material.

An analysis of the cost of this covering gives, for one square yard—

53.70 pounds bituminous stone, at 1¼ cents per pound,	$0.67.125
4.70 pounds Bastenne tar, at 5¼ cents per pound,	0.24.675
Labor, fuel, use of utensils, &c.,	0.19.230
Total cost per square yard,	$1.11.030

In a letter to Major Smith, dated New York, September 2d, 1840, Mr. John Barrell, agent for the London Bastenne Company, offered

* The report of the company stopping operations was communicated to the Engineer Department, in a letter of Major Smith to the Chief Engineer, dated New York, February 16th, 1841; but in a letter which has been received at this department, dated Paris, February 24th, 1841, "Aug'te Baboneau & Comp'ie, Proprietaires des Mines d'Asphalte, du Val-de-Travers, (Suisse,)" offer to supply, in New York, any amount of the mineral tar and asphaltic stone.

to furnish that mastic, properly prepared for laying, at about one and a half cents per pound, independent of freight.

In September, 1839, one hundred and twenty-six square yards of "asphalte" (bituminous mastic) was laid by Mr. Caylers, agent for the Val-de-Travers Company, upon the stone paving of the upper terre-plein of Castle Williams, New York, at $ 1.25 per square yard. Upon a recent examination of this covering, it was found to be soft and brittle, and had no adhesion to the paving stones.

In June, 1840, Mr. Lowitz offered to lay, in the public buildings at Washington, pavements of the natural asphaltic composition for twenty-five cents per square foot, or to make a pavement three-fourths of an inch thick, partly of "natural asphalte," and partly of an artificial mastic, ("mastic cement,") for twenty-two cents per square foot. The application of this mastic as a covering to the Exchange in New York, is said not to have succeeded well. The following proportions for the ingredients of this "mastic cement" of Mr. Lowitz, were furnished to the compiler by Mr. Mills, the architect of the public buildings in Washington:—

100 lbs. of asphaltic stone,	} No limestone being used.	
10 lbs. of mineral tar,		
50 lbs. of sand,		
Total, 160 lbs.		

The following is the proportion of the ingredients taken for five hundred and fifty square feet of bituminous mastic laid down at White Hall, in London:—

0.25	ton of	bituminous matter,
0.75	"	limestone *(calcaire,)*
0.50	"	gravel,

Total, 1.50 tons for an area of five hundred and fifty square feet, one half inch thick. From this it appears that one square foot of this paving requires one pound of the asphaltic stone, and about six pounds of limestone and gravel, making in all seven pounds. From these prices, Mr. Mills estimates the cost of the same mastic in Washington:—

One pound of the bituminous matter, duty free,	$ 0.05½
Six pounds of limestone and gravel,	0.00½
Preparing and laying the mastic,	0.05
Total cost per square foot,	0.11
" " " yard,	0.99

Mr. Mills also gives the cost of furnishing and laying a marble flagging in the public buildings in Washington, per square foot, $ 0.62½

Ditto of Seneca stone,	1.00
Ditto of German stone,	0.37½

Mr. Saltonstall, agent of the Bastenne Company, proposed to pave, with that bituminous mastic, an area of twenty-three thousand feet, in the new Treasury and Patent Office buildings, at fifteen cents per square foot. The agent in Philadelphia, of the Seyssel Company, pro-

posed to execute the same work for twenty-five cents per square foot of covering, half an inch thick. No trials have, as yet, been made of either. Four hundred and seventy-two square feet of Lowitz mastic were laid down, about one year since, under the east steps of the Treasury building, which has stood perfectly well. A few feet were at the same time laid upon the lower terrace, where it is exposed to the heat of the summer's sun and the frost of winter; it also has undergone no change. A covering of Coyle's artificial resinous cement was also laid both without doors and within. In both cases it has already been cracked and otherwise injured by the frost.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on Coyle's Resinous Cement above referred to. By ELLWOOD MORRIS, C. E., *one of the Collaborators for the department of Civil Engineering.*

This cement is *a resinous mastic*, consisting of various proportions of dry clay in powder, compounded with the common rosin of commerce, by melting the latter in a caldron; and stirring in the powdered clay, whilst the rosin is kept in a fluid state by heat.

In 1838, Thomas C. Coyle, the patentee of this mastic, which he called the *American Cement*, published a small pamphlet filled with favourable certificates, from gentlemen who had inspected his specimens; and to one of these, which he presented to the writer, was appended a printed sheet, giving directions concerning the manufacture and application of the cement; which we re-print, as being necessary to a full understanding of the subject.

Brief Directions for preparing the materials, and for making and applying the American Cement.

"Select a piece of ground composed of good brick, or potters', clay; remove the soil by means of a plough; plough up the clay, and harrow the same; toss and handle it until it is completely dry. The dried clay is now pulverized by passing through a cylindrical mill, made of wooden rollers, similar in construction to a rolling, or sugar-cane, mill, with this exception, that the rollers are placed alongside of each other, instead of one above the other. A hopper is placed above the rollers for the convenience of feeding the mill. Beneath these rollers is placed a *wire screen*, in an inclined position, and by means of a small crank gives it a quivering motion; the clay dust will thus deposite itself beneath the screen, while pieces of stone, &c. &c., will be carried off down the inclined screen.

"*For making the Cement.*—Take from one to ten iron kettles (as the job may warrant) containing from ninety to one hundred and twenty gallons each, walled up in the same way that hatters' kettles generally are, or let the kettles be cast, and each set in a furnace sufficiently large to receive fuel enough to boil the cement, and placed

* Mr. Mills' manuscript letter to the compiler, dated July, 1841.

upon truck wheels; this will be found very convenient in executing small jobs of work. Take rosin of a good quality, and put into each kettle a quantity so as to fill, when melted, about one-fourth of each kettle. When the rosin is completely melted, commence adding the pulverized clay in such quantities as can be promptly incorporated with the rosin; a great boiling, or effervescence, takes place at the union, and almost entirely ceases when the union is complete. A brisk fire should be kept up until the cement begins to emit bluish smoke, which is the surest test that all vegetable matter is boiled away, and the cement ready for application. During the whole time, the cement should be kept stirred by the following means: Let a stirrer be placed in each kettle, with arms crossing at right angles; between these arms let it be interwoven with hoop iron, and a crank attached to the stirrer.*

"*Application.*—The cement is removed from the kettles by means of iron dippers attached to handles four or five feet long, or let the kettles be cast with a tube to project about one foot, and of sufficient size to admit of the cement passing out into tubs, or buckets, and carried to the place of application. It would be utterly impossible to lay down any general rule for the application of the cement that would embrace a great many of the jobs; this must be regulated by the good sense of the practical mechanic, according to circumstances. The following, however, have the inventor's experience to test their utility. When a vessel, wall, or pier of any kind, is about to be formed, let a frame be made of stout planks the size of the vessel intended to be built. It is a general rule to cast the bottom of all vessels first, then start the frame for the upright walls; let the frame be well braced from each side, so that the pressure of the cement may not cause it to spring or warp, then pour in the cement in its fluid state till the space be filled. When the cement becomes hard, the frame can be taken away. To prevent the cement from adhering to the planks, let paper, or some other substance, be spread over the planks; by this means the frame can be removed with ease and despatch. In building the wall of a fort, lock of a canal, or any work of magnitude, either to keep water in or out, if the work is required to be exceedingly strong, pack your stones loosely; raise your wall—say three feet at a time; place at the distance of four or six feet apart, iron or wooden pipes; pour your cement through these pipes; by this process the cement passes through the interstices till it gains its level on the top, filling with accuracy every part. While the cement is yet hot, the pipes or tubes must be removed, and when the cement becomes hard, let the walls be continued by the same process until they are raised to the extent required. This process could be proved on a small scale to the satisfaction of the most sceptical, by filling a barrel, or any other vessel, with stones, and grouting the same with the cement, then breaking the mass into fragments. It will bear sufficient testimony to the mind of what can be done on a larger scale."

* The kettles can be worked by manual labor or horse power, according to the magnitude of the job.

Mr. Coyle's patent bears the date of August 18, 1837; and the claim in substance is for *the application* of this mastic, "*in places or vessels which contain water.*" The composition itself was not claimed, having been long known, though but little used.

In the year 1838, a large body of this cement was applied to form a floor within the Licking Aqueduct of the Chesapeake and Ohio Canal; with the view of obviating those filtrations, which so commonly produce a dripping soffit, in the stone arches of canal aqueducts.

With regard to its use in this case, the following information was derived, by the writer, from personal inspection, and the official reports of his assistant in charge of the work.

The floor referred to, was formed by a mass three feet in depth, of angular fragments of limestone, of the size of a man's head, grouted full of the resinous cement, melted and poured in hot; side walls, several inches thick, were then formed of the cement alone, rising about a foot on each side, to cover the rubble work, and join the cut stone ashlar facing of the aqueduct trunk; and the expense of the whole, including Mr. Coyle's superintendence and all other charges, as stated in his bill, amounted to a little over $2,000.

The aqueduct arch has a span of ninety feet—the width of the trunk occupied by the rubble stone cemented floor, is $17\frac{95}{100}$ feet—the mean length of the same is $95\frac{4}{10}$ feet—and in consequence of the extrados of the arch occupying a small space, there were 152 perches of rubble stone used, each perch containing twenty-five cubic feet.

The total quantity of the resinous cement used at the aqueduct, was 2,720 bushels, of which 680 were manufactured in Baltimore, and brought to the work in fragments barreled up; the remaining 2,040 bushels were made on the margin of Licking creek, using the clay found on the left bank near the site of the aqueduct; the rosin alone for this portion was brought up from Baltimore, and the 2,040 bushels, consisted of 1,548 bushels of dry clay in powder, commingled with 492 bushels of rosin, or *three and one-seventh parts of clay by measure, to one part of rosin*—this was the general average, though in a great deal of it, the clay was incorporated with the rosin, in the proportion of *two and six-tenths part to one.*

The specific gravity of this mastic as made here was 1,886, and the weight of the cubic foot $117\frac{7}{8}$ lbs. Of the 2,040 bushels of cement manufactured at the aqueduct,

The actual cost—of digging, delivering, and preparing the clay—of the rosin delivered—and of the whole application of the cement—supposing the work prepared to receive it,—the kettles set up ready for use—and exclusive of any charges for superintendence, or for the use of the patent—was as follows:

164 barrels of rosin in Baltimore - -		at 125c	$ 205.00
164 do do transported to the work, over 62 miles of railroad, and 44 miles of turnpike, = 106 miles, aggregate haul,		at 168c	275.52
Labor.	141 days work of men,	at 131¼c	185.06
	16 do of carts,	at 156¼c	25.00
516 barrels of clay cost nothing,			0.00
Total *actual cost* of 680 barrels of mastic made,			$ 690.58

Each barrel contained three bushels—therefore the cost of a barrel of the cement as made here, was $\frac{\$\ 690\frac{58}{100}}{680}$ or 102 cents per barrel; and the cost per bushel was 34 cents.

Being used without any admixture of sand, which enters so largely into, and so much reduces the expense of, common hydraulic mortars, this mastic is very costly in its application: thus to grout the 152 perches of rubble stone, *loosely placed*, required 1,300 bushels, or $8\frac{55}{100}$ bushels per perch, *costing*, (at the ascertained price of 34 cents per bushel,) $2.91 *per perch for the mastic alone.*

Some rough experiments which were made during the progress of this work, showed that Coyle's mastic contracted in cooling, about $\frac{1}{20}$th part of its bulk in the fluid state, and this aroused at the time, in the mind of the writer, strong doubts as to its resisting, with success, the changes of temperature incident to our climate; subsequent experience at this work and others, has shown that these doubts were well founded, and it may now be pronounced, that the dilatable and contractile properties of this cement, render it unfit for use in the open air, because it possesses but little ductility, and cracks to pieces under the effects of frost; another evidence of its deficient ductility, may be gathered from the fact that it admits, like stone, of being freely sledged into fragments: the writer also noticed that in hot weather—when the sun's rays reflected from the cut stone walls of the aqueduct trunk, rendered it an unusually warm position—prints of the footsteps of persons, passing over the mastic, remained upon its surface.

The patentee states in his pamphlet, in speaking of this cement, that "its imperviousness has been tested, by subjecting a plate of it, one-fourth of an inch thick, to the pressure of a column of water *twenty feet high*, without affecting it in the least." And the writer, from what he has seen, entertains no doubt that when in sufficient mass, and free from cracks, *it is* impenetrable to water; if then it were used in situations which admitted of its being protected from great atmospheric changes, by a covering of earth, or other means; it seems highly

probable that there are cases in construction, where it may be made very useful in preventing filtrations.

The cement under consideration is very adhesive both to stone and wood, if they are clean and free from dust, of which the interposition of but a small film appears to be sufficient to impair, very essentially, its adherent properties.

The writer having noticed that when the cement was brought from the caldrons and poured upon the cold rubble stone, it very quickly became viscid and ceased to run, conceived the idea that its penetration into a mass of fragments of stone would be very limited in depth; and upon mentioning this to Mr. Coyle, that gentleman (with a readiness to make experiments to satisfy objections, which always distinguished him,) immediately caused a hogshead, four feet in height, to be filled with stone, and then grouted up with the resinous cement; at a subsequent period the hoops were knocked off, and the staves being removed, the cemented mass was sledged up, (splitting indifferently through both stone and cement, like a homogeneous body,) and it showed *no cavities in any part:* this was accounted for by the fact that the body of stone was comparatively small and easily heated up—the shape of the vessel favorable to the retention of heat—and the material composing it a non-conductor; the writer then took up and examined a portion of the rubble stone floor which had been apparently grouted full—but numerous cavities were found at the depth of a foot and a half; which induced the subsequent carrying on of this work, *in layers of one foot deep.*

The net actual cost of the "American Cement" (clear of all profit) *being* $ 2.91 *per perch of* 25 *cubic feet of wall,* or nearly treble that of the calcareous cements generally used in hydraulic works, it is not at all likely that this mastic will supersede them in ordinary constructions, though situations will occasionally occur where it may be used with propriety, if the cost of the Bituminous mastics, or other circumstances, should prevent recourse being had to them.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on the Injudicious Policy pursued in the Construction and Machinery of many Railroads in the United States. By JOHN C. TRAUTWINE, *Civil Engineer.*

I have read, with much pleasure, an able pamphlet, entitled "*The causes which have conduced to the failure of many Railroads in the United States,*" written by Mr. Charles Ellet, Jr., Civil Engineer, of Philadelphia.

Mr. Ellet proves, in my opinion, most satisfactorily, that the cause

of so many failures in railroad enterprises in the United States, is not to be traced to any defect in the system itself, but to the injudicious application of the resources of the companies, to the accomplishment of the object to be effected.

There has been much more money expended on many of our railroads, than either their present or prospective resources could possibly justify. Even admitting that the anticipations of their warmest advocates, as to their probable amount of trade, had been fully realized, a little calculation would show that an expenditure altogether disproportionate even to *that* amount has been thoughtlessly lavished on many of our enterprises. Indeed they have, with, however, several honorable exceptions, been commenced, and carried on, with so little reference to the principle of adapting the means to the end, that it is only matter of surprise that so great a number of them sustain themselves even so well as they do.

This position is so amply supported by the numerous failures to realize the anticipated results that were to follow the construction of many of our railroads, as to need no labored arguments in its behalf. The fact speaks for itself more convincingly than any thing I could say on the subject; indeed, I am not certain that I should have ventured to enter my feeble protest against our present heedless system of railroad making, had I not been sustained by so incontrovertible an argument: for when the current of public opinion once sets strongly into a determined channel, no matter how ill directed its course may be, it is rarely that good results to him who ventures to stem it. It is only after the vessel, entrusted to its stream, has struck upon the rocks, that one may, without apprehension of censure, strive to save the fragments of the wreck, or mark out the dangerous spot upon the chart.

The chief cause of these failures has been, as Mr. Ellet remarks, our want of attention to first principles. We are too much an *imitative* people; and, in our endeavours to keep pace with England, whose vast pecuniary resources, and concentrated commerce, enable her safely to reduce to practice those abstract principles, the union of which constitutes the "beau ideal" of a railroad, we overlook the great disparity that exists in the trade and financial capacities of the two countries;—almost unlimited in the one, but comparatively restricted in the other.

The moment news reaches us of some important change in railroad policy adopted by the mother country, no matter what expense its application necessarily involves, our engineers are not content until they effect its introduction upon the several works under their charge.

Now there is certainly nothing culpable in this disposition to avail

ourselves of the experience of others;—on the contrary, where a *parity of considerations exists*, it is wise to follow the beaten track. But it is equally certain that a blind adoption of every abstract improvement—without regard to any existing disparity of means or of secondary causes calculated to neutralize its beneficial effects—may be justly deprecated.

The engineer, before he can decide properly on the details of his location, superstructure, machinery, &c., must ascertain as an essential element of his decisions, not only what is the probable *amount* and *nature* of the trade which the road will be required to accommodate, but whether or not it will present itself in such quantities, and at such intervals of time, as will admit of loading the engines nearly up to their full capacity of draft.

If the trade is so heavy as to require many engines, and so regular that nearly full loads may be depended on, he will of course find it advisable to encounter great expenses for light grades, heavy rails, and powerful engines; because, abstractly considered, a certain amount of power is much more economically maintained, and applied through the medium of one large engine than of two or more smaller ones; and the use of such powerful engines necessarily involves that of proportionally heavy rails and superstructures.

Again, still further to reduce the number of engines by enabling them to draw maximum loads, the grades, or acclivities of the road, must be reduced as much as possible.

A perfect railroad would be that on which the least imaginable force would draw the greatest imaginable load; such a road is evidently a theoretical one; it can never be attained in practice; but it is the duty of the engineer to approximate to it in every instance, as closely *as the trade of the road, and the interest of the company, will admit.*

It follows then, that the above considerations of grades, weight of engines, rails, &c., although not reducible to any one fixed rule for their application to practice, still have certain limits which we may not transcend with impunity. It is plain that every railroad, to some extent, constitutes a case by itself;—it requires its own peculiar calculations; and the engineer must modify, and remodify, his assumed outlays for gradients, curves, engines, rails, &c. until he attains that happy medium in each, and consistency in all, that will best subserve *the interests of the company. That* must be his guiding principle; and if he hopes in every case to attain that end, by simply making for them a railroad combining in itself all the improvements of the age, the chances are greatly in favor of his being disappointed.

It is not the *best railroad,* but the *best paying* railroad, that should

be aimed at; and the two are by no means necessarily associated in our country, except in comparatively few instances.

Experience has shown that we may assume the annual expense of running such engines as are now in common use on all our railroads, at about $5,000 each; and as $5,000 is the interest at 6 per cent. on $83,333, we see that the engineer may very properly incur considerable expense in diminishing the number of engines requisite for maintaining the traffic of the road. But it happens on many of our railroads that the number of engines employed, is less dependent on the grades, or even on the amount of transportation, than on the *number of trips* which the nature of the business requires to be made daily. This business may be so great as to yield a fine revenue, and yet not of such a nature as to require either high grades, heavy rails, or powerful engines; but on the contrary, such that if grades, rails, and engines of this kind be provided for it, the result must inevitably be a failure of the enterprise.

Such are the cases that constitute the numerous railroad failures in the United States. Nothing but the want of knowledge of, and attention to, the principles that influence the expenditures warrantable in each instance for the attainment of light grades, easy curves, and heavy superstructure, has led to so general a disappointment among railroad adventurers, and excited sentiments of distrust with regard to the system itself. Indeed no argument could probably be adduced, so favorable to the merits of the railroad cause, as that it has survived the horrible manglings inflicted on it ignorantly by its best friends. It has struggled through a long and well fought contest against both friends and foes; and now stands forth in its might, victorious, though wounded almost to the death.

The grounds of every expenditure on a railroad should be, that the annual saving thereby induced, shall more than counterbalance the interest on the increased cost. To this test, not only the general character of the line, but every deep-cut tunnel, bridge, and other important work along it should be submitted, before it is finally decided on; and this cannot be done, unless the engineer is previously in possession of some general data, as to the amount, nature, and regularity of the anticipated trade of the road.

It is upon this principle that the enormous original outlays on the English railroads are so willingly encountered. The English engineer first ascertains that the transportation will not only justify a first rate road; but that in order to accommodate it, with a due regard to economy, the road *must* be a first rate one.

But our American engineers, *as a class*, do not descend to first principles. It is enough for them, that such and such improvements

have been introduced in England;—omitting all considerations of the premises, they look only to the conclusions; and the imitative faculties are forthwith called into requisition, without any regard to the modifying, and controlling circumstances peculiar to their own case. They dash on blindly in their operations, deluded by the impression that they cannot err, if they only adhere closely to their English copies. Deep cuts, high embankments, heavy rails, powerful engines, long tunnels, expensive masonry, &c. &c. are all decided on, as matters of course, whenever an opportunity offers, without a moment's reflection that the interest on their cost may never be repaid by their services—but that, on the contrary, they must for ever operate as drains on the annual revenues of the company.

Yet with the data of probable amount and nature of the trade, together with the expenses of transportation as now developed by experience, the adoption or rejection of all these things admit of an easy determination. But unfortunately it is easier to point towards England, than to make calculations even of the most simple character.

This servile imitation, or rather attempt to imitate the splendid practice of the English engineers, without either the motives, or the means for carrying it out, has been the source of incalculable injury to the railroad cause in the United States. All would be well, were we content to investigate the *principles* upon which their practice is founded; for by adhering to those principles, we should, (as would they also in our circumstances,) arrive at a system of construction entirely different from that which their unlimited trade, and equally unlimited finances, now warrant them to adopt. The same *principles*, lead to *totally different practice*, in different circumstances.

Having ascertained, approximately, the probable amount and nature of the trade which the road will be required to accommodate, and knowing pretty nearly the rates of carriage it will bear, we arrive at a sum which constitutes the gross annual receipts of the road. If from this amount we deduct a portion sufficient to defray the annual expenses, we have the yearly profits. These profits are the interest on the principal which we will be justifiable in expending on the construction and furnishing of the road.

Self evident as the propriety of this simple precautionary process of calculation is, and impossible as it would appear to be, (and acttually is,) to decide properly on the character of the contemplated road, and its machinery, without it, yet it has not probably been resorted to by the engineers of one road in ten that has been constructed in the Union. When the engineer commences his location, his aim almost invariably is, to obtain the *best* abstract line; and whether his road is to obtain 5,000, or 50,000 tons annually, the character of his

grades, curves, superstructure, machinery, &c., will be precisely the same. His standard of propriety is an invariable one; it adapts itself to no contingencies; it admits of no accommodation to difference of objects to be effected. It is summed up in the brief sentence, "the English do so."

The usual routine is pretty much after this manner, viz: the survey is made; the map drawn; and the grades and curves laid down *without any reference to the object or cost of the road;*—then the calculations of cost are made;—and finally, to make both ends meet, an exhibit of probable revenue is concocted, *to suit the Report!*

The road is made; it does not pay; the railroad system "won't do." I do not mean to insinuate that this mode of proceeding is resorted to with the intention to deceive; but that it does deceive, and that ruinously, is undeniable. We are apt to be led astray by our prejudices in favor of any project in which we are personally interested. Every engineer considers his road to be a little more important than any other in the world; and under the influence of such feelings, imaginary freight flows to it, from all quarters, without limit. Like the Legislator's conscience, it is "equal to any emergency;" and it is unfortunate that it is so. Were it otherwise, reports and profits would coincide much more nearly. Now, most of our railroads that have failed to pay well, have been constructed principally for the purpose of accommodating, from two to four times a-day, the passengers, baggage, and freight brought to them either by some other connecting line of railroad, or by stages, or steamboats. But few, if any, of those connecting large cities may be considered as failures. I hope to show that to conduct such a business as that represented in the first case, does not, as is generally supposed (and practiced on) necessarily involve a company in enormous expenses, for easy grades, powerful engines, and heavy rails. In attempting this, I shall, for the sake of illustration, suppose a case, and carry it through.

The amount thus to be transported, say only twice a day (once in each direction) may, generally speaking, be carried by a single light engine, weighing, with her complement of fuel and water, not more than six tons, over grades as high as sixty feet to a mile, by merely slacking her speed at such points.

Let us suppose that an engine of this light weight, would take, over such grades, a gross weight of only thirty tons, exclusive of her tender; and let us see how much business one such trip daily, in each direction, would amount to in a year, of 300 working days. At first sight, this may appear to many of my readers, like taking a very contracted view of the subject; but before we conclude, it may, perhaps, assume a somewhat more imposing aspect. The six ton engine is

assumed merely to show how small a power can, on a railroad, satisfy a considerable business. In practice I should recommend, for such a superstructure as is hereafter described, eight ton engines.

Gross load of an engine weighing six tons, with her compliment of fuel and water in the boiler, but exclusive of her tender, over grades of sixty feet to a mile.

	Tons
40 passengers and their baggage,	4
Passenger cars, - - -	7
Freight, - - -	12
Freight cars, - - -	7
Total, - - -	30 tons, gross load.

Now if we suppose only one such trip daily in each direction, and assume 300 working days to the year, we have annually,

24,000 passengers.
7,200 tons freight.

Let our road be fifty miles long;—the charge for passengers $2.50;—and for freight $4 per ton. Then we have for the gross income of the road,

24,000 passengers, at $2.50,	$60,000
7,200 tons freight, at $4,	28,800
	$88,800 gross annual receipts.

And this, it will be remembered, may be accomplished by two engines, (one for each direction daily) so small in comparison to those which are now coming into favor for *all* roads, as to appear like models: and over grades of sixty feet to a mile, with an eight ton engine, an addition of about fifty per cent. might be made to the above amount of trade and income, with but a trifling increase of expense. But now let us see whether so small an income as $89,000 per annum, would justify the construction of a railroad fifty miles in length.

Experience has shown that the annual expenses of our railroads, generally range within from thirty to fifty per cent. of their income; varying, of course, with many circumstances, which it would not be to our purpose to expatiate on in this place. There can be little doubt that these expenses would be materially diminished on most of our roads, by the use of lighter engines and cars, lower rates of speed, and Kyanized timber for the superstructure; but, although our road contemplates all those conditions, still we shall assume fifty per cent. of the gross receipts, as necessary to defray the gross expenses.

If then from the $89,000 of gross income of our road, we deduct fifty per cent. (say $45,000,) for expenses, there remains the sum of

$44,000 of clear annual profit. Now $44,000 is the interest at eight per cent. on a capital of $550,000; which amount, and no more, we would be justifiable in expending in the construction, and equipment, of a railroad fifty miles in length, intended to accommodate so small a trade as we have assumed, in our example; and required to realize dividends of eight per cent. per annum.

If from this capital of $ 550,000, we set aside $ 50,000 to cover the expense of furnishing our road with engines, cars, water-stations, depots, &c., there still remains $ 500,000, for the construction of the road itself; which in this case, is equal to $ 10,000 per mile.

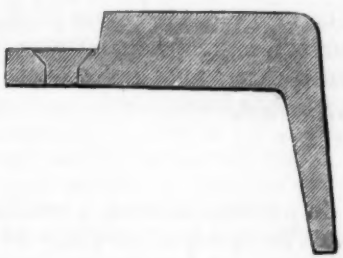
Here then it is evident, that if we wish "to keep up with the age," and to build a road of the best *abstract* character, our project must be abandoned; because the sum of perhaps from $ 20,000, to $ 30,000 per mile, would be required to construct such a one. And although we should even be convinced that at some future day, distant perhaps ten or twenty years, the road would, by the gradual accumulation of business, be able to realize profitable returns on this large investment, still adventurers could scarcely be found so confiding in these prospective advantages, as to embark their capital in it.

But in the case before us, I should certainly advise not to keep up with the age; but to go back to those ancient times, some five or six years past, when flat bar roads were in fashion; the old flat bar road, that has been so unmercifully crushed out of existence by our mammoth engines, of the present day. I entertain a high regard for the flat bar road; and conceive that the odium which is now attached to its memory, has not been justly incurred. Does it follow, as a matter of course, that because it is not adapted to very heavy trades, necessarily involving the use of powerful engines, and a resort to high velocities, that therefore it may not be very serviceable, nay, more serviceable than any other, in cases where the limited business admits of lighter engines, and does not justify the construction of a more expensive road? The outcry against the flat bar road, has, in my opinion, but little foundation in justice. It is, like our more permanent structures, good in its place; and its place is, where light engines, moving at moderate velocities, can satisfy all the demands of the trade at less expense, than heavy engines on the more permanent roads can do. And such cases are very numerous. The reader cannot, I presume, infer from this, that I should recommend to substitute the flat bar for the 75 lb. rail on the Liverpool and Manchester road; in that event, I should, beyond all controversy, be "behind the age;" but, by inversion, I conceive that any one who should advise to employ the 75 lb. rail, at its enormous expense, upon a road on which the cheap light bar would answer every purpose, would be equally open to censure.

However, we are digressing from our subject; let us see what kind of railroad we can construct for $10,000 per mile.

In the first place, I would limit the weight of the engines to the maximum of eight tons; and would allow no greater weight on any one engine or car, than one ton. The speed of passenger trains should not exceed twelve or fifteen miles per hour; nor that of freight trains seven or eight miles. The grading, it is needless to say, should be for a single track; the acclivities should coincide as nearly with the natural surface of the ground as the maximum would admit of, provided said maximum did not seriously interfere with the time of making the trip, or render assistant power necessary. Sudden changes of grade should of course be eased by vertical curves. But trifling expense should be incurred for horizontal curves of greater radius than about 1500 feet; and should any very serious object require it, I should admit of radii as short as 300 feet.

The superstructures if not piled,* should consist of log cross-ties, and of six by six inch strings, supporting a flat bar, or rather *flanched* bar, similar to that on the South Carolina railroad; but smaller, as shown in the figure, two thirds size.



Finally, the whole of the timber should be thoroughly Kyanized, or otherwise protected from decay.

Now, so far from expecting this superstructure to be knocked to pieces in a few years, as the old flat bar roads generally were, I should calculate on its annual repairs being less than on perhaps any railroad in the United States: and that, not from any inherent virtue in the road itself, but from the simple fact that *all its parts are fully proportioned to the offices they have to perform.* We should have no crushings or deflections here; but with its light engines, it would be one of the stiffest roads in the Union; and moreover, a much more agreeable one to ride on, than any of those of more permanent construction. Beside which, it would annually yield eight per cent. clear profit in its cost, when doing only the moderate business of one trip daily in each direction, with a small *model* engine, over grades of sixty feet per mile; or, should the business require the use of eight ton engines, it would yield twelve per cent. profit on the same number of trips: or should two trips daily in each direction be necessary with such loads, it would yield twenty-four per cent. profit.

* See my paper on Piled Superstructures, page 226.

Below is an estimate of its cost. If the professional reader should think the item of grading too low, (and it is, I suspect, the only one on which he will have any doubts) let him take the profile of almost any road in the United States, and relocate it, in imagination, so as to adapt it to sixty feet grades, and he will find the allowance to be ample.

Estimate per mile, single track, of such a Railroad as the foregoing.

Grading, culverts, drains, road-bridges, &c.,	$ 4,000
Fencing, (1400 panels at 50 cents, $ 700; but allowing fencing only half way,)	350
Land damages,	400
Cross-ties—1760, at 25 cents,	440
String timbers, 35 thousand feet board measure, at $ 25,	875
Iron flanched bar—24 tons, at $ 65,	1,560
Splicing plates,	30
Spikes,	100
Workmanship, 1760 lineal yards, at 50 cents,	880
Surveys, engineering, instruments, &c.,	800
Earle-izing, 13,000 cubic feet, at 2½ cents,	325
Incidentals,	220
Total,	$ 10,000

In northern climates, a small addition to this sum would be advisable for broken stone under the cross-ties.

Thus we see, that such a road as we speak of, can be constructed for the moderate sum of $ 10,000 per mile. Yet how many railroads are there in the United States, not enjoying even the limited business to which this road is adequate at two trips daily, on which not only thousands, but tens and hundreds of thousands have been thoughtlessly squandered for light grades, heavy rails, and powerful engines.

[TO BE CONTINUED.]

Facts and Observations on Four and Six Wheel Engines. By JOHN HERAPATH, ESQ.

[CONTINUED FROM PAGE 249.]

London and Birmingham Railway.—Conceiving, the only way I could possibly come to a right conclusion of the cause of any difference in the safety of the engines, was to travel upon them, I procured orders for permission to do so. These orders are absolutely necessary on some of the lines where the injunctions are most strict not to allow any one to go upon the engines. On the London and Birmingham it is as much as a man's place is worth to permit it.

By taking the engine, I was enabled to decide very easily respecting the sinuous motion which is indeed, upon any line in good order, the only sensible motion; for the pitching motion is obviously insensible if the road be good, the draughts steady, and the coupling link about upon a level, or not much above the axle of the driving wheels. The rolling motion, too, I have not yet been able to detect, unless the road was out of order.

My method of judging of the amount of sinuous motion was to fix myself firmly at the end of the engine, and observing how much a point on the front of the frame of the engine deviated to the right or left of the rail, taking as much care as I could to make the visual line fall at the same distance in all engines before the front axle. This is the best practical method I could think of, and though it might not be mathematically accurate, perhaps it would be much more easy to find fault with it than practically to find a better. By a little care one is able to decide pretty correctly in this way, of the difference of sinuous motion between two engines. For instance, if one appears to deviate two inches and another three, which a practised eye can appreciate very well, the one has half as much motion again as the other, and so on. I have thought of, and tried, other ways for the same object, but could find none so satisfactory as this simple plan.

The front rolling motion I have best detected by watching the motions of the front fire-box—not the motion of the chimney, for that is often loose and a bad guide—with regard to the road or rails, taking care, however, to distinguish between it and the sinuous motion. In the hind part of the engine it becomes sensible by leaning one's back or shoulder against the side of the fire-box. In a similar way is the pitching motion discovered, that is, by watching the lifts and depressions of the front of the smoke-box, and by leaning against the hind part of the fire-box. But a person with a sensitive foot, and accustomed to ride upon engines, will soon feel any pitching in the engine. Engines which appear to one standing on the platform to move very smoothly, when tested this way, that is, by leaning against the fire-box, will often develope the most unpleasant motions, and create very disagreeable sensations.

But besides the rolling, pitching, and sinuous motions, some engines have a shuffling motion on the platform from side to side, keeping time nearly with the beats of the pistons. It is made manifest by leaning against the side rails on the platform. Others again have the same shuffling motion in length, discoverable by the same method as the pitching, and distinguished from it by its quickness and regularity, and keeping time with the pistons.

Again, there is often a vertical roughness upon the platform, very different over the same ground on different engines, and a most treacherous guide it is to try an opinion upon; the causes of which I shall describe in my report.

Monday, November 15, I started from Camden Town station on No. 41, taking the morning mail train which was driven by a very intelligent man. This engine, a four wheel one, was one of Mr. Bury's make, and one which, from its being so high, some might call

top-heavy. Its motion, however, was very free from rolling or pitching, except in some few places where the road has suffered from the late bad weather. I could, indeed, perceive no sensible difference between the rolling or pitching motion of this engine, and that of any of the three six-wheel engines, I rode on the Saturday previous on the South Western Railway. The apparent sinuous motion was about two inches, except once or twice when it might have reached two and a half or three inches. This, reduced to the distance of the axles, would make a real sinuous motion of one to one and a half inch. In other respects the engine was very pleasant to ride on, and I understand is esteemed to be a very good one. I stopped at Tring, but when I arrived a Wolverton I very carefully gauged the inside bearing marks of the flanches, and found them to be four feet seven-ninth inches, the gauge of the rails being four feet eight and a half inches. The distance from the extremity of the fire-box to the middle of the hind axle is four and three-quarter feet, distance of the centres of the axles six feet, and total length of the body of the engine, including the fire-box, is fourteen and three-quarter feet. The driving wheels are five and a half feet diameter, the cylinder thirteen inches, and the stroke eighteen inches. I was informed that it consumed twelve cwt. of coke, on an average, between Camden Town and Wolverton, fifteen miles, or twenty-six and a quarter lbs. per mile, but these data we shall hereafter have more accurately. This engine runs up with the night mail and down with the morning mail every day, and has had, I was informed, no material repairs done to it for about eight months.

All the mail train engines are an inch greater in diameter in the cylinders than the engines of the other trains, though the driving-wheels appear to be nearly the same, that is five and a half feet. The coupling link appeared to be about two or three inches above the level of the driving-wheel axle.

This engine is fitted with a guard to clear the rails, and a ballast gauge; that is a bar hung upon a pin coming down a little distance from the inside of the fore wheel to within two or three inches of the level of the axle, on the top of which bar, in a notch, is supported a lever, which, when the bottom of the bar is struck by the ballast being too high, is released, and falling, sets a whistle off; thus telling the tale of the ballasters having neglected their orders as to the height of the ballast where the roads are repairing. This happened in our journey, and was obliged to be reported at head-quarters. Such is the attention to everything on this line which may engender accident.

At Tring I left this engine and waited for the next train, having been informed that all the engines are changed at Wolverton.

The engine I now got on was No. 50, a four-wheel engine, made by Benjamin Hick. Its length, from the end of the fire-box to the axle of the driving-wheels was four and a half feet, ten feet to the fore axle, and thirteen and a half feet the extreme length of the engine. The driving-wheels as before were five feet six inches, cylinders twelve inches, with eighteen inch stroke. This was a much lower engine than the former, and I suspected at first a more steady one, but on getting up its velocity I found it had considerably more sinu-

ous motion, which I suspect was chiefly on account of its flanches being only 4 feet 7.1 inches, to a gauge of 4 feet 8½ inches, and great play in its bearings. The coupling link was placed about the same as in No. 41.

The engine driver informed me that No. 50 consumed about fourteen cwt. of coke in the journey of fifty-one miles, or 30.7 lbs. per mile; but with a strong head wind often-times it made a difference of two or three cwt. more.

At Wolverton I got upon No. 54, another of Bury's engines. This in cylinder, stroke, height, and distance of axles, was nearly a counterpart of No. 41, but its extreme length is half a foot less, and the gauge of its flanches four feet 7.6 inches. It had, therefore, about three-tenths of an inch more play on the rails, and it appeared to me to be less steady than No. 41, and not so lively as No. 50, but steadier. The driver said it consumed a ton of coke in its journey between Wolverton and Birmingham, sixty miles, or about 37.3 lbs. per mile; but the accuracy of his statement I should doubt, as he appeared to be not well-informed. At Rugby I got inside, having traveled eighty-five miles outside in rather sharp and snowy weather upon three of the Company's engines.

I could get no information from the men of any peculiarities in the structure of any of these engines, that is, whether they worked expansively or not, but with all this I expect to be supplied by the Company's officers.

As far as I have yet seen, Bury's engines do not deserve the character given of them of being "top heavy." One thing, however, is to be said that the road, taken altogether, is in so good a state of repair as not to exhibit any imperfections, if they exist. Indeed the term "top heaviness" in a good road is unintelligible; it can be only in roads much out of order, and curves badly constructed, that it can have an existence. On the London and Birmingham line there is no expense spared to make and keep the road in a perfect state of repair, and with a few exceptions it is in excellent order.

But though I can at present see no foundation for the clamour raised against Mr. Bury's engines, I must confess I think they can and ought to be made more comfortable for the men. The platform, for instance, round the fire-box is open at the sides, and bitterly cold, while a very little expense would remedy the defect. Indeed, upon the South Western, Birmingham and Gloucester, and Liverpool and Manchester, engines, that I have ridden on, it is done, and I cannot see why it should not be on the London and Birmingham.

Another fault I have to find with the fitting-up of these engines is, that many of them have no "dashing," or "splashing," guards, over the front wheel. In wet weather the wheels for want of them throw the oxide of iron from the rails, dirt, and particles of ballast, over the engine and the men, in a most annoying degree. Nay, from the several sharp blows I have myself had in the face with these particles, I am inclined to think it is not without danger to the men's eyes, and may therefore deter them from keeping so good a look-out as they otherwise would. The force of this seems now to be seen, for as fast as the engines undergo repair they are provided with splashing guards.

While I am complaining I must also be permitted to prefer another complaint, namely, against the breaks on the tenders. On Mr. Bury's tenders lever breaks are used, upon the arm of which the men stand, over the side between the tender and engine, pressing it down with the weight of their bodies. Should their feet slip, destruction is almost inevitable. Indeed, upon one of these dangerous things a man lately lost his life on one of the lines, and that Company are now preparing what they call shoes for the handles. But if these breaks were fitted as they are upon the tenders of many lines, with a screw and handle, or wheel, all this danger would at once be avoided.

Mr. Bury will not, perhaps, thank me for telling him thus publicly of his faults, but I do it because it is the most effectual way to cure him of committing them again. Besides, to confess the truth quietly, I have a little mischievous inclination just now to grumble and pick holes where I can. It is exhilarating to an exhausted frame, a sort of unction to the bumps and bruises I have gotten in my long and fatiguing journey.

[The rest of this communication we have deferred, the information from the London and Birmingham Railway coming only just before Mr. Herapath's departure.] Railway Mag.

[To be continued.]

Progress of Practical & Theoretical Mechanics & Chemistry.

Remarks on Ships of Wood and Iron.

Remarks on the relative advantages of the employment of wood and iron in the construction of ships have appeared at different times, in Journals devoted to inquiries relating to subjects of this nature, but a spirit of partizanship has been commonly displayed by the respective advocates of wood and iron in favour of their own views. In an endeavour to avoid this charge, it will be expedient to advert in the first instance, to the different modes in which wood can be employed in ship building, especially as the advocates of iron are in the habit of referring to the defects of ships built of timber, which are capable of being obviated by a different system of construction.

The relative merits of wood and iron for this purpose will, I apprehend, come more fairly before the public by an exposition of some of the plans that may be adopted in the construction of ships of wood; and it appears to me that three well marked systems may be distinguished. 1st. The common plan of timbers, whether framed or single, separated by spaces from each other, whose principal connexion with each other, arises from an external and internal series of planking. 2nd. The plan used in her Majesty's dock yards, of timbers wedged up solid, and covered by an external planking, (timbers placed close together I conceive would be found to be a better method.) 3rd. A plan of constructing vessels of any size by two or more connected series of planks without timbers; this method has not been extensively used. Clinker-built boats belong to this third system, and perhaps also iron vessels, inasmuch as the plates of iron of which they are formed are of far more importance than the iron ribs, which occupy the position of timbers.

The advocates of iron have, I apprehend, by no means exaggerated the defects of ships of the common construction, in which the connexion of the timbers with each other is extremely imperfect, even in the best built merchant ships, and the safety of the largest vessels is dependent on the security of the fastenings of the butts of a four inch plank.

I consider these defects are so fatal, that no increase of strength or improvement in workmanship can more than palliate them in a greater or less degree, and I propose to abandon any reference to these vessels, and at once admit their inferiority to vessels constructed of iron, provided the latter are made of sufficient strength.

A large proportion however of the present enormous annual loss of merchant ships seems to have been sufficiently traced to defective methods of construction, and to the facility it affords in covering the defects of cheap ships; still the causes that tend to foster the continuance of the present system are subjects foreign to the tenor of these remarks; the fact that the rottenness of the timbers can be concealed from casual inspection, is sufficient for our purposes. It has been urged that unless spaces are provided between the timbers, for the accommodation of water from leaks, that it would rise in the vessel and spoil the cargo. This argument is founded on the assumed necessity of leaks, but it affords proof of their frequent occurrence in vessels of the usual construction.

The rapid destruction of timber by the united operations of wet, heat and filth, and the generation of foul air from these causes, will not be denied; and in addition to its weakness the rapid deterioration of the frame of the vessel, from the above causes, seems an equally fatal objection—though exceptions may occur owing either to care or accidental conditions.

The second system of ship building with timbers wedged up solid, has been in use for a considerable period for ships of war, and the success that has attended this plan has been amply proved by the accounts of the escape of different vessels, that have since its adoption been driven ashore and got off again, in many instances without injury, and in other cases damaged to such an extent as would have insured the total loss of vessels of the common construction; for instance, the *Pique* lost a large portion of her keel, and in some places the whole of the garboard strake, and a part of the floor timbers were ground away by the rocks of Newfoundland, and yet this frigate crossed the Atlantic without a rudder, under circumstances, it must be admitted, of some anxiety to the officers and crew.

For merchant ships I should propose to use the same weight of materials as are now employed, the outside planking would remain without alteration, but the quantity of wood in the ceiling would be added to the width of the timbers, and in case it was insufficient to fill up the spaces between the timbers, the depth of the latter must be lessened to make up the deficiency.

Under these circumstances the timbers would be about double the thickness of the outside planks, and being placed close together, a good means of connexion might be obtained by large dowells or coaks,

so as to produce a mutual dependence on each other, and so that any pressure on the outside would exert a more regular strain on every part. A vessel constructed on this principle would be an irregular cask, and when caulked inside and outside would float without planking; and by the addition of the latter, a frame of great stiffness, and equal strength and thickness in every part would be obtained, on which one side of every piece of wood used in its construction would be visible, and would allow an examination to be made of its state with great facility. The other sides of the wood would be preserved from wet as long as the fabric of the vessel remained sound, and the caulking was attended to. It is obvious that a greater inside width of seven or eight inches would be gained in these vesels, and no loss of space would accrue if it was occupied by battens to admit of water accommodation for the leakage, and the prevention of injury to the cargo from the escape, until at least the present advocates of the assumed necessity of leaks in ships, became convinced of the small prospect of their occurrence under common circumstances in vessels so constructed.

It is true no provision will afford security to vessels on rocks among breakers, but such situations afford the best test of the merits of different systems of ship building, by the time each vessel is found capable of resisting these effects.

Numerous cases will occur where life is dependent on the time the vessel holds together, but the partial saving of the cargo may be considered objectionable by ship owners, among whom the advantages of a total loss are well understood. Opinions on these points are of little value, we must wait for evidences from wrecks under different conditions.

The scantling proposed for merchant ships would, I apprehend, be not quite so heavy as that in use for ships of war of equal size; at the same time, it is probable that the strength of timbers placed close together, except that of the dockyark plan of timbers wedged up, to such an extent that a greater strength may be perhaps obtained at a smaller cost. Plans of this nature are obviously only suited for good workmanship and good materials; but it ought to suit, for less insurance premiums, whenever an inquiry on this subject is properly conducted, and explanations are afforded to insurers of such a nature, as shall be fully understood.

The third plan referred to, requires similar conditions of timber and workmanship, but it has not been extensively adopted. Ten or twelve series of inch planks were employed many years ago, in a 500 ton vessel built at Rochester, but I conceive three or four series of two and a half to four inch plank, according to the size of the vessel, would be found a more convenient method of construction.

Several of the Gravesend steamers of 150 feet in length have been built of three series of one and a half inch planks, and they have run for four or five years, and are now said to be as sound as when first constructed, such at least was the case with the Ruby, when opened for the purpose of lengthening the bow to increase her speed.

This method however requires further trial, especially at sea, before

any decisive opinion can be given on its comparative merit; it is favourable to soundness, as the necessity of sawing the wood into planks admits of the certain selection of good materials, and would afford great facility in seasoning timber properly. While the expense of selection would in some degree be lessened by the conversion of the rejected planks to inferior purposes, or by working it up in inferior or cheap craft, perhaps for river use. The increase of cost would not answer unless it was accompanied by a proportional increase of durability, and perhaps the general opinion would be in favour of the latter result, as a necessary consequence of the selection of good timber.

The launches used in the navy have for several years been made on Johns' plan, of two series of planks crossed diagonally, their weight is about three-fifths of the boats of the old construction, and their durability has been much increased. The Gravesend steamers are built with two similar series of crossed planks in lieu of timbers, covered with an outside planking in the common mode, the whole well fastened with copper. In large vessels perhaps a ceiling connected in the same manner might be deemed advisable: at the same time it seems probable that a greater strength would be obtained by a less quantity of timber in the third than in the second method of construction proposed. Clinker built, which belongs to this class, in which the principal strength depends on the planking instead of the timbers, seldom exceeds 100 tons in size, and are usually of a light scantling; their great durability is well ascertained, provided they are kept from the ground, in which case from the thinness of the single part of the planking, holes are easily knocked in their bottoms.

The introduction of these methods of constructing timber ships is not likely to be effected, except by the nearly total destruction of the present trade in ship building by the more general adoption of iron vessels, and the interests of humanity will cause the earliest occurrence of this result not to be regretted. Nothing perhaps but the severe pressure of iron competition will induce the present race of ship builders to turn their attention to the means whereby greater strength, security and durability may be given to wooden ships; eventually perhaps its greater strength for a given weight, and its greater elasticity may obtain a preference.

Prime cost undoubtedly will form a principal element in the approaching competition; at present iron vessels are often built too cheap, or in other words too slight; the error may be, and I believe has been remedied. Innumerable questions will arise relating to the elasticity, strength, and durability of wood, as well as its quality; and also in reference to the destructive action of salt water on iron, the strain on the rivets, &c. &c., which can only be answered by experience.

To a spirited competition between wood and iron I look for the improvement of vessels of both materials. Recently I have met with parties who being engaged simply as owners on the proposed construction of a steam boat, in consequence of the difficulty in the choice of wood or iron, have found it necessary to institute an inquiry re-

specting their relative merits in ship building; these parties but for the difficult of selection, would have gone on in the good old jog-trot way of supposing, that British ships of the old construction were perfect specimens of the art, and would have patiently submitted to the present rates of insurance, as founded on the average loss, deduced from defective ships. The spirit of inquiry once roused among owners of shipping, will I trust lead to results as yet scarcely anticipated.

It matters little to the country whether wood or iron eventually obtain the preference; if British oak is abandoned it will be only superseded by British iron, and the inhabitants of our land ought to be satisfied if the latter will uphold the character of the navy as well as the former has done.

At present I consider the question of relative superiority as undecided, and though disposed to admit the inferiority of timber vessels of the common construction, yet the advantages of iron may not exceed that due either to the methods of construction adopted in the navy, or in the Gravesend steam boats. The latter method is perhaps best adapted for small, and the former for large vessels. Moreover, we want the evidence likely to be afforded by the wreck of the largest iron steamers, for the formation of an opinion respecting their powers of endurance under the breakers of a rocky shore, or a sand bank.

In regard to the relative advantages of the two plans of ship building proposed for the merchant service, the method adopted in the navy has received the stamp of experience, and the evidence is conclusive in its favor. The 500 ton vessel built of planks before alluded to, was driven ashore in a heavy gale under Mount Batten, in Plymouth Sound, when loaded with ordnance stores, in company with ten or eleven other vessels, all of which became total wrecks; she afforded an almost solitary instance of a vessel saved, when ashore on that point, and she is reported to have rebounded from the rocks for a short time like a cask, until a hole was knocked in her bottom; after the gale she was got off, and was repaired at a moderate expense, and proceeded on her voyage to the East Indies.

I should also be inclined to the opinion that a greater strength will be obtained with a less quantity of materials, by means of several series of planks than by close timbers and outside planking, but the latter plan seems to afford greater facility for repairs. In conclusion, I would remark that it is my object to assert the possibility of the introduction of great improvements in the construction of vessels of wood, without any increase and perhaps at some reduction of cost, and I wish to induce parties engaged in ship building to advert to the fact, that the best portion of their business, the construction of steamers, is rapidly passing out of their hands, and that unless sailing vessels are rendered stronger, safer, and perhaps lighter, this portion of their trade may follow, as the establishments for building iron vessels are increased, or at least such a depreciation of prices may occur as will be equally ruinous to them.

At the same time I must acknowledge that great improvements in regard to strength have been necessary, and have been adopted in many of the larger steamers, in some instances perhaps to the full ex-

tent here advocated, at least in the engine room; similar principles might be adopted in the fore and after bodies with lighter timbers, and hence a less strain would be thrown upon the midship body in passing over heavy seas. It is their general adoption that I would urge, and I cannot but express my conviction that steam ships of the largest class yet made, may be constructed to bear the winter seas of the Atlantic, by a better disposition of the timbers employed in their construction. Y.

Civ. Eng. & Arch. Jour.

On the Extraction and Decolorization of Gelatine.

By J. C. Booth and M. H. Boye.

In a patent granted to S. G. Dordoy, of Surrey County, "for certain improvements in the manufacture of gelatine size and glue," (see London Journal for January 1842,) the patentee proposes the employment of chlorine, for bleaching the materials employed, previously to the extraction of the gelatine, in which respect the patent mainly differs from former attempts at bleaching by operating on the gelatinous fluid after its extraction.

"For every 100 lbs. of the animal substances, eight ounces of chlorate or chloride of lime, potash, soda, baryta, or other similar compounds are dissolved, or thoroughly mixed in, or with, two, or more, gallons of hot or cold water; four pounds of hydrochloric or other acids being added and stirred thoroughly. This mixture is to be poured into the vessel containing the water and animal substances, the materials being stirred continually while the mixture is added. The animal substances should be kept entirely covered with the water for twenty-four hours."

The above proportions are considered sufficient for thin skins, as of sheep, but for heavier pieces, such as those derived from oxen, calves, &c., two or three steepings will be requisite, each continued the same time, until the substances appear of a uniform, transparent whiteness. The substances are thoroughly washed in pure water at ordinary temperatures, and then water at 160° Fahr. is poured on, and the temperature maintained at 100° Fahr. from twelve to twenty-fours hours, when the gelatinous solution is strained off. Fresh supplies of water are successively added, each portion at a temperature of 20° higher than the preceding, until at last the water is boiled.

This patent, like many others, makes a sweeping claim "to cover all the ground," but it might be restricted to the use of chlorine or its compounds with oxygen for bleaching animal matters previous to the extraction of gelatine, and not subsequent to this process, which had been repeatedly tried. In the latter case it has been found that although the color of the gelatine may be improved, its binding quality is materially impaired; but there is every reason to believe that the coloring matters may be obviated by the application of bleaching previous to extracting gelatine, since it is the opinion of chemists that this substance is not ready formed in the animal matters employed. Since then the patent contains good principles, it may be well to enquire into some of its details.

As is too often the case with chemical patents, its descriptions are vague and incompatible with the definite laws of chemistry. Thus it is not immaterial whether we employ the same amount of acid (of what strength?) with the same quantity of chlorate of potassa, soda, lime, or baryta, or with the chlorides of the same bases. Probably the chloride of lime is the only compound that can be employed economically; and in this case, if, as the patentee directs, the acid, which is twice as much as necessary, be poured first into the solution of the chloride, a considerable amount of chlorous or bleaching material will be lost. It would be advisable either to dissolve the chloride in two or more gallons of cold water and then add the acid previously diluted with three or more gallons of water, or to add the clearly drawn off solution of chloride to the water over the animal substances, and then to add the acid diluted largely with water. In either case, a bleaching liquor will be obtained which will act more uniformly and for a greater length of time without being exhausted.

The successive extraction of gelatine by water at low and increasing temperatures is worthy of notice, although not novel, but in this case the later solutions should be employed for gelatine of decreasing qualities.

On the Preparation of Aluminous Mordants. By James C. Booth and M. H. Boye.

Whatever relates to improvements in dyeing and cloth printing being of high importance, we have thought it worth calling attention to the above subject from the appearance of two patents, the one taken out in England by R. Hervey, (Rep. Pat. Inv., December 1841,) and the other in this country, (Jour. Frank. Inst. March, 1842.) They are worthy of consideration from the comparative cheapness with which the aluminous mordants may be prepared.

The most important point is the formation of sulphate of alumina by the direct action of sulphuric acid upon clay which has been calcined in a reverberatory furnace. Supposing the process to be successful, as described by the patentee, it offers great advantages, since an abundance of clay comparatively free from iron may be obtained in many districts of country, and even a portion of that iron must be rendered insoluble by calcination. In one respect the sulphate of alumina may be more advantageously employed as a mordant or color-base than the sulphate of alumina and potassa (common alum) since a given weight of it will contain a larger proportion of color-base than the same weight of alum; but, on the other hand, crystalized alum is so uniform in composition, that in its employment we operate more definitely and certainly, according to given weights, while the sulphate of alumina is difficult to be brought to a crystaline state. It is, moreover, liable to form basic salts, so that we cannot know with certainty and readiness the exact amount of alumina present in a solution of the salts. For these reasons the patentee is in error in supposing that the sulphate of alumina is superior to alum for printing, dyeing, &c.

The sulphate of alumina may be more successfully employed in the manufacture of the acetate, by means of acetate of lime or lead, for by decomposing alum perfectly, it is requisite to add a sufficient quantity of acetate to precipitate the whole of the sulphuric acid, not only that combined with alumina but also with the potassa, so that a considerable amount of the acetate is employed to no useful purpose; whereas for every proportion of the sulphate of alumina alone that is decomposed by an acetate, an equivalent quantity of acetate of alumina is formed. The most economical method is to precipitate with *acetate of lime* as long as a precipitate is formed, and then to throw down the small balance of sulphuric acid by *acetate of lead.* The second method described in the English patent, of precipitating alumina by alkali, or its soluble carbonate, and then redissolving the alumina in acetic acid, may often be practised economically, but there is then some difficulty in obtaining a liquid of uniform strength.

The remarks which have been made apply to both the American and English patents, and particularly to the latter, which is more copious. Since each of the points claimed in the patents has been the subject of previous experiments and manufacture, it appears to us that it would be a difficult matter to sustain the combination since other simple methods of removing the iron may be resorted to.

On an Uniform System of Screw Threads—communicated to the Institution of Civil Engineers, 1841. *By* Joseph Whitworth, Esq., Assoc. Inst. C. E.

The screw threads which form the subject of this paper, are those of bolts and screws, used in fitting up steam engines and other machinery. Great inconvenience is found to arise from the variety of threads adopted by different manufacturers. The general provision for repairs is rendered at once expensive and imperfect. The difficulty of ascertaining the exact pitch of a particular thread, especially when it is not a submultiple of the common inch measure, occasions extreme embarrassment. This evil would be completely obviated by uniformity of system, the thread becoming constant for a given diameter. The same principle would supersede the costly variety of screwing apparatus, required in many establishments, and remove the confusion and delay occasioned thereby. It would also prevent the waste of bolts and nuts which is now unavoidable. The impulse and direction given to machinery during late years have tended to increase these evils, and must ultimately lead to a change of system.

Were an uniform system adopted for marine or locomotive engines, there can be no doubt that it would be extended to engines and machinery of almost every description. Peculiar threads will, of course, be always required for particular purposes; but in screws for general use in fitting up machinery, the advantage of uniformity would be paramount to every other consideration.

It does not appear that any combined effort has been hitherto made to attain this object. As yet there is no recognized standard. This

will not be a matter of surprise, when it is considered that any standard must be to a great extent arbitrary. It is impossible to deduce a *precise* rule from mechanical principles, or from any number of experiments. On the other hand, the nature of the case is such that mere approximation would be unimportant, absolute identity of thread being indispensable.

Messrs. Whitworth & Co. were led some years ago to alter the threads of their screwing tackle on this principle, in consequence of various objections urged against those they had previously adopted, and the result of the experiment has been abundantly satisfactory. An extensive collection was made of screw bolts from the principal workshops throughout England, and the average thread was carefully observed for different diameters. The ¼, ½, 1½ inches were particularly selected and taken as the fixed points of a scale by which the intermediate sizes were regulated. The only deviation made from the exact average was such as might be necessary to avoid the great inconvenience of small fractional parts in the number of threads to the inch. The scale was afterwards extended to six inches.

The pitches thus obtained for angular threads are shown in the following table:

Diameter in inches.	¼	5/16	⅜	7/16	½	⅝	¾	⅞	1	1⅛	1¼
Threads to the inch.	20	18	16	14	12	11	10	9	8	7	7
Diameter in inches.	1⅜	1½	1⅝	1¾	1⅞	2	2¼	2½	2¾	3	3¼
Threads to the inch.	6	6	5	5	4½	4½	4	4	3½	3½	3½
Diameter in inches.	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	6
Threads to the inch.	3½	3	3	2⅞	2⅞	2¾	2¾	2⅝	2⅝	2½	2½

It will be observed that above one inch diameter the same pitch is used for two sizes. This could not have been avoided without introducing small fractional parts. The economy of screwing apparatus was also promoted by repetition of the thread. Lon. Mec. Mag. Oct. 1841.

On a Voltaic Process for Etching Daguerreotype Plates. *By* W. R. Grove, Esq., M. A., F. R. S., *Professor of Experimental Philosophy in the London Institution.**

Dr. Berres, of Vienna, was the first, I believe, who published a process for etching Daguerreotype; his method was to cover the plates with a solution of gum-arabic, and then to immerse them in nitric acid of a certain strength. I have not seen any plates thus prepared, but the few experiments which I have made with nitric acid, have given

* From the Proceedings of the London Electrical Society, Part II, having been read before the Society on the 17th of August, 1841. Revised by the Author.

me a burred and imperfect outline; and I have experienced extreme difficulty of manipulation from the circumstance of the acid never attacking the plate uniformly and simultaneously. My object, however, in this communication, is not to find fault with a process which I have never perhaps fairly tried, or seen tried by experienced hands, and the inventor of which deserves the gratitude of all interested in physical science; but to make public another, which possesses the advantage of extreme simplicity, which any one, however unskilled in chemical manipulation, may practise with success, and which produces a perfect etching of the original image; so much so, that a plate thus etched can scarcely be distinguished from an actual Daguerreotype, preserving all the microscopic delicacy of the finest parts of the impression.

One sentence will convey the secret of this process; it is to make the Daguerreotype the *anode** of a voltaic combination, in a solution which will not of itself attack either silver or mercury, but of which, when electrolyzed, the anion will attack these metals unequally. This idea occurred to me soon after the publication of Daguerre's process; but, being then in the country, and unable to procure any plates, I allowed the matter to sleep; and other occupations prevented for some time any recurrence to it.

Admitting the usual explanation of the Daguerreotype, which supposes the light parts to be mercury, and the dark silver, the object was to procure a solution which would attack one of these, and leave the other untouched. If one could be found to attack the silver and not the mercury, so much the better; as this would give a positive engraving, or one with the lights and shadows, as in nature; while the converse would give a negative one. Unfortunately, silver and mercury are nearly allied in their electrical relations. I made several experiments with pure silver and mercury, used as the anode of a voltaic combination; but found, that any solution which would act on one, acted also on the other. All then that could be expected, was a difference of action. With the Daguerreotype plates I have used the following:—

Dilute sulphuric acid, dilute hydrochloric acid, solution of sulphate of copper, of potash, and of acetate of lead. The object of using acetate of lead, was the following:—With this solution, peroxide of lead is precipitated upon the anode; and, this substance being insoluble in nitric acid, it was hoped that the pure silver parts of the plate, being more closely invested with a stratum of peroxide than the mercurialized portions, these latter would, when immersed in this menstruum, be attacked, and thus furnish a negative etching. I was also not altogether without hopes of some curious effects, from the color of the thin films thus thrown down; here, however, I was disappointed: the colors succeeded each other much as in the steel plate used for the

* Strictly speaking this is a misapplication of Faraday's term: he applied it to the surface of the electrolyte; as, however, all continental and many English writers (among whom I may name Whewell) have applied it to the positive electrode, and as an expression is most needed for that, I have not hesitated so to apply it.

metallochrome, but with inferior lustre. On immersion in nitric acid of different degrees of dilution, the plates were unequally attacked, and the etching burred and imperfect. Of the other solutions, hydrochloric acid was, after many experiments, fixed on as decidedly the best: indeed, this I expected, from the strong affinity of chlorine for silver.

I will now describe the manipulation which has been employed by Mr. Gassiot and myself, in the laboratory of the London Institution, with very uniform success. A wooden frame is prepared, having two grooves at 0.2 of an inch distance, into which can be slid the plate to be etched, and a plate of platinum of the same size. To ensure a ready and equable evolution of hydrogen, this latter is platinized after Mr. Smee's method; for, if the hydrogen adhere to any part of the cathode, the opposite portions of the anode are proportionately less acted on. The back and edges of the Daguerreotype are varnished with a solution of shell-lac, which is scraped off one edge to admit of metallic connexion being established. The wooden frame with its two plates, is now fitted into a vessel of glass or porcelain, filled with a solution of two measures hydrochloric acid, and one distilled water (sp. gr. 1.1); and two stout platinum wires, proceeding from a single pair of the nitric acid battery, are made to touch the edges of the plates, while the assistant counts the time; this, as before stated, should not exceed thirty seconds. When the plate is removed from the acid, it should be well rinsed with distilled water; and will now (if the metal be homogeneous) present a beautiful sienna-colored drawing of the original design, produced by a film of oxychloride formed;—it is then placed in an open dish containing a very weak solution of ammonia, and the surface gently rubbed with very soft cotton, until all the deposit is dissolved; as soon as this is effected, it should be instantly removed, plunged into distilled water, and carefully dried. The process is now complete, and a perfect etching of the original design will be observed; this, when printed from, gives a positive picture, or one which has its lights and shadows as in nature; and which is, in this respect, more correct than the original Daguerreotype as the sides are not inverted; printing can therefore be directly read, and in portraits thus taken, the right and left sides of the face are in their proper position. There is, however, *ex necessitate rei*, this difficulty, with respect to prints from Daguerreotypes,—if the plates be etched to a depth sufficient to produce a very distinct impression, some of the finer lines of the original must inevitably run into each other, and thus the chief beauty of these exquisite images be destroyed. If, on the other hand, the process be only continued long enough to leave an exact etching of the original design, which can be done to the minutest perfection, the very cleaning of the plate by the printer destroys its beauty; and, the molecules of the printing ink being larger than the depth of the etchings, an imperfect impression is produced. For this reason it appeared to me, that at present, the most important part of this process is the means it offers of multiplying indefinitely Daguerreotypes, by means of the electrotype. An ordinary Daguerreotype, it is known, will, when electrotyped, leave a faint impression: but in so doing it

is entirely destroyed; and this impression cannot be perpetuated; but one thus etched at the voltaic anode, will admit of any number of copies being taken from it. To give an idea of the perfect accuracy of these, I may mention, that in one I have taken, on which is a sign-board measuring on the electrotype plate 0.1 by 0.06 of an inch, five lines of inscription can, with the microscope, be distinctly read. The great advantages of the voltaic over the chemical process of etching, appear to me to be the following:—

1st. By the former, an indefinite variety of menstrua may be used; thus, solutions of acids, alkalies, salts, more especially the haloid class, sulphurets, cyanurets, in fact, any element which may be evolved by electrolysis, may be made to act upon the plate.

2nd. The action is generalized; and local voltaic currents are avoided.

3rd. The time of operation can be accurately determined; and any required depth of etching produced.

4th. The process can be stopped at any period, and again renewed if desirable.

The time I have given is calculated for experiments made with one pair of the nitric acid battery; it is, however, by no means necessary that this be employed, as probably any other form of voltaic combination may be efficient. It would seem more advisable to employ a diaphragm battery, or one which produces a constant current, as otherwise the time cannot be accurately determined. It is very necessary that the silver of plates subjected to this process be homogeneous. Striæ, imperceptible in the original Daguerreotype, are instantly brought out by the action of the nascent anion; probably silver, formed by voltaic precipitation, would be found the most advantageous. I transmit with this paper some specimens of the prints of the etched plates, and of electrotypes taken from them; and in conclusion, would call attention to the remarkable instance which these offer, of the effects of the imponderable upon the ponderable: thus, instead of a plate being inscribed, as "drawn by Landseer, and engraved by Cousins," it would be "drawn by Light, and engraved by Electricity!"

I would suggest the employment of hyposulphite of soda instead of ammonia to remove the oxychloride. Philos. Mag., Jan. 1842.

London Institution, Saturday, Aug. 14, 1841.

The Artesian Well of Grenoble.

At Grenoble, in the vicinity of the French capital, it was considered advisable some years ago to endeavour to procure good water by means of an Artesian well. M. Mulot d'Epinay was the engineer to whom the task was entrusted. On the 31st of December, 1836, the bore had been carried, after immense labor, to the depth of 383 metres, (a metre is 3 feet and 2-10ths English.) The soil was a clay, very hard and compact. In the month of June, 1839, the bore had reached the depth of 466 metres, and the soil was still a bed of clay, though a variety of strata had been previous passed. M. Mulot kept

a regular journal of observations, relative to the soils and strata penetrated, and the temperature at different depths. This record will be valuable when published. At length, after a task of seven years one month and twenty-six days' duration, M. Mulot was rewarded by a degree of success proportioned to the time and trouble expended. Water was not only found, but found under such circumstances, and in such quantities, as will cause the well to be one of the most useful works as well as one of the greatest marvels of artistical ingenuity in France. The fluid burst out in a perfect torrent, rising to the surface of the bore to the amount of nearly three cubic metres in a minute, or 180 metres in an hour, and 4320 metres in the twenty-four hours. Such is the force with which it flows up the shaft, that it mounts more than thirty-two English feet above the surface of the ground. M. Hemery, director of roads and bridges, has calculated that the force of ascension of the water, at the bottom of the shaft, exceeds, by fifty times, the force with which water rises in a vacuated tube of thirty-three feet. The orifice of the well is fifty-five centimetres (about one foot eight inches) in diameter, and at the bottom it is eighteen centimetres in diameter. The shaft is in all 547 metres, (or 1630 French feet) in depth, and the sides are strongly plated with iron to a depth of 539 metres. The dome of the Invalids, which has an elevation of 300 feet above the ground, is thus only about a fifth of the perpendicular measurement of the Artesian well of Grenoble.

Three times, during the operations, did the shaft give way, but the indefatigable engineer was not daunted, and at last he has had his reward. The water, which the well pours forth incessantly, has converted one of the neighboring streets into a river, but the workmen are at present employed in forming a channel for its proper conveyance from the spot. As might be expected, the fluid was at first mixed with sand and earth, and continued to be so for some time. It is perfectly sweet, however, and had no odor of a disagreeable kind, or any other deteriorating qualities. It is of such a temperature, that there is an obvious smoke arising from it when it reaches the surface. This is a feature not likely to continue, and indeed easily removable before use. The whole cost of this great work of art to the city of Paris is said to have been 160,000 francs. The perseverance in this labour for such a period of deferred success, is to be ascribed to the confidence resulting from modern geological discoveries; and the value of these is most splendidly shown by the success attained. By an ingenious contrivance, M. Mulot has been able to raise large quantities of sand from the bottom of the well; thus clearing the water more rapidly, and also adding very considerably to its force and volume. This removal of the sand has been attended with curious consequences in more respects than one. After ceasing, in a great measure, to throw up sand, the well has begun to throw up shells and petrifactions of various kinds, the debris of a former world. The success of the operations of Grenoble has also induced engineers to make similar attempts in other quarters. One is begun on a large scale at Vienna.

Mining Jour.

Wear of Granite Pavement.

During seventeen months, the following was the relative wear of a pavement made of the granites named, laid down on the Commercial road in London:—Guernsey, 1.0; Herm (an island close to Guersey), 1.19; Budle (a Northumberland whinstone), 1.316; blue Peterhead, 2.08; Heyton, 2.338; red Aberdeen, 2.524; Dartmoor, 3.285; blue Aberdeen, 3.571. These differences are very considerable, and are, in a great measure, to be attributed to the mineralogical structure of the stone, granite being composed of at least three species, mica, feldspar, and quartz, of which the quartz is the hardest and the mica the softest. Permeability to wet is also a rapid cause of disintegration, especially in conjunction with frost. It is melancholy to see many of our public edifices rapidly hurrying to decay, from the bad quality of the stone employed in their erection. Great attention should be paid to the qualities of the stone, in selecting railway blocks; although the opinion of railroad engineers is now most inclined for timber bearings. Leaving out the question of first and last cost, longitudinal timbers with iron cross trees, decidedly make the most pleasant road; and the effect of this, not only on the passengers, but the engines and carriages will, in our opinion, put the ultimate cost on one side. We shall not easily forget the smoothness of the Great Western Railway, which was so evident as to admit of no doubt, although when we went on it, we were much prejudiced against it, from what we had heard; our prejudices were soon dispelled.—*Railroad Journal.*

Civ. Eng. & Arch. Jour. Nov. 1841.

Experiments on the Strength of Brick and Tile Arches. By Thomas Cubitt, Assoc. Inst. C. E.

In the course of his extensive building engagements, the author had occasion to construct some fire-proof floors; he therefore wished to ascertain how the greatest amount of strength could be attained, with a due regard to the space occupied, and the cost of the structure.

Two arches were built, each with a span of fifteen feet nine inches, and a rise of two feet.

The brick arch was two feet wide, and composed of half a brick in thickness, with cement.

The tile arch was two feet four inches wide, and built of four tiles, set in cement, forming a thickness of four and a quarter inches.

The spandrels of the arches were filled up level to the crown with rubble work and cement. A load of dry bricks was placed along the centre of both arches, and gradually increased at stated periods, from twelve cwt. three qrs. up to 160 cwt. at the end of seventy-five days, when the abutments of the brick arch gave way; and the tile arch broke down while loading.

Ibid.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1841.

With Remarks and Exemplifications by the Editor.

1. For an improvement in *Door Locks and Latches;* Enoch Robinson & William Hall, Boston, Massachusetts, March 3.

The latch bolt is connected with the fork, which is operated by the tumbler, or lever, on the spindle of the knobs, by a round shank surrounded by a helical spring—the fork being provided with a separate spring in the usual way. The spring on the shank of the latch should be of less strength than the one on the fork.

The object of this improvement is fully expressed in the following claim, viz: "We claim as our improvement arranging the latch bolt with an additional spring, which shall operate the same on closing the door to which the lock is applied, independently of the spring which acts on the knob, the whole being constructed substantially as herein set forth."

2. For an improvement in the machine for *Hulling Clover Seed;* William C. Grimes, York, Pennsylvania, March 3.

The patentee says,—"In the construction of machines for hulling clover seed, it has been a common practice to depend rather upon acute asperities to break the hull, than upon a more permanent principle, or structure, less affected by use; hence such machines have become speedily defective as they became worn; the seed passing through the machine in a current too thin, or diffuse, for the round teeth or asperities to act with sufficient force upon the light and scattered pods or hulls to break them."

"In my machine the hulling is effected while the chaff and seed (in a mass) is under a pressure produced by centrifugal force; thus the effective power of the machine is rapidly increased with its activity."

A runner is attached to the lower end of a vertical shaft, and is provided with teeth above and below, and on its outer periphery, which is rounded. The teeth on the upper surface extend much nearer to the shaft than on the under surface—the space between the inner ranges of teeth and the shaft being occupied by arms which admit of a current of air to pass upwards. The upper end of the shaft is provided with a fan consisting of arms or vanes—and the whole is surrounded by a case, that part which surrounds the fan, being provided with a valve or damper to regulate the current of air, and the part which surrounds the runner with teeth on the inside, to correspond with and pass between those on the runner.

The grain is fed in through a hopper, that opens into the case near the inner circle of teeth on the upper surface of the runner, and by the action of the centrifugal force it is forced outwards, towards, and around, the periphery, and then along the bottom towards the centre, where

it meets with a strong current of air, produced by the fan at the top, which carries up the chaff and permits the grain to fall down. The centrifugal force resists the escape of the grain at the bottom, but as the body of grain is greater at the top than at the bottom it is forced out.

Claim.—"What I claim as new, and as my invention, and desire to secure by letters patent, is the manner of hulling clover or other seed, under a pressure produced by centrifugal force, after the manner and upon the principle herein before set forth; that is to say, the seed in the hull is passed through a hulling chamber, in which it first diverges from, and then convey it towards, the centre; centrifugal force subjecting the seed and hull to a pressure, less or greater, according to the velocity of the wheel, spheroid or runner, as it passes over or around the bilge or periphery of the same."

Secondly.—"I claim the combination of the fan with the hulling wheel or ring, and operating after the manner, or upon the principle, above described."

Thirdly.—"I claim the mode of regulating or maintaining a nearly uniform current of air through the machine, by means of a valve or door, operating after the manner or upon the principle herein before set forth."

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3. For an improved mode of *Rendering Fabrics Water Proof;* George John Newberg, a citizen of the United States, residing in London, England, March 3; patent to run 14 years from the 12th of May, 1840, the date of the English Patent.

The patentee says—"My improvements in rendering silk, cotton, woollen, linen, and other fabrics water proof, consists in an improved mode, manner, or process, of rendering such fabrics water proof, and is effected by using drying oils and oil compositions, varnishes, or other suitable composition for this purpose, in such a way that one side of the fabric when finished presents an appearance unimpaired, or but little altered, by the process of water proofing, and therefore keeps its original appearance or nearly so, and this I effect by applying siccative, or drying, oils and compositions in such manner that when finished the appearance of one side only of the texture is altered, (that is to say,) the oil, or paint, or water proof composition, coats, or covers, the one side, while it does not cover or injure the appearance of the other side, or but little so.

"One method by which my improved mode, method, or process may be carried into effect is to use oil baths (about a quarter or half an inch deep will be found sufficient) of proper dimensions to allow the frame containing the strained silk, or fabric, to float thereon; the upper surface of the fabric being left exposed to the action of the atmosphere, or artificial heat. Another method, or modification of process, of carrying my improvements into effect is as follows, viz: by merely laying the saturated fabric on a slab, or slate, or stone, or metal, or other surface or material, non-absorbent to oils, or such mat-

ters, and this I consider a more simple and convenient method of effecting the objects of my improvements."

The method of producing damask patterns is thus stated—"Instead of having a plain table, or surface of slate, or of wood, placed in contact with that side of the fabric, part of which is only partially to be protected from the drying action of the air, or heat, I lay, or spread, the saturated silk, or fabric, upon a surface, or table, or block, which has a pattern formed upon it, such pattern being sufficiently countersunk, or raised, (say about one-eighth of an inch) after the manner of ordinary calico, or paper, stainer's pattern blocks. The raised parts of this pattern block, or table, being placed in close contact with one side of the saturated silk, or fabric, that is, the one intended to have the pattern formed upon it and the fabric stretched over it, the indented, or sunken parts, recesses, or interstices of the pattern not being filled with the composition, will allow the water proofing material to harden or become pellicled on both sides in some parts, while the raised parts will prevent such effect taking place."

"I claim, as new and useful, the improved mode, methods, or processes, or modifications above described, of applying substances to such saturated textures so as to prevent one surface thereof from drying, hardening, or forming a pellicle thereon, while the other is allowed so to do by the action of the atmosphere, or artificial heat, to which it is exposed, evaporating a portion of the aqueous or volatile parts of the oils, or compositions, and then afterwards clearing away the moist parts by the agency of spirits of turpentine, or other suitable liquids. And also, I claim the mode, manner, or process of producing damask patterns, or designs, on the surface of such fabrics, in the way or manner above stated."

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4. For a *Refrigerator;* Job S. Gold, city of Philadelphia, Pennsylvania, March 12.

This refrigerator consists of a square, or other formed, double box, with a space between the two, filled in with any bad conductor of heat. The inside is provided with shelves, open at the ends to allow of a free circulation of the air from one compartment to the other. At the top, or upper part, there is an apartment, or reservoir, for ice, and at the side there is another reservoir for ice water, the upper part thereof communicating with the bottom of the ice chamber, and the lower end being provided with a cock for drawing off the water.

The claim is, first, to the separate apartment for the ice at the top or in the upper part of the refrigerator, substantially as described. Second, to the combination of the ice water reservoir and the arrangement of the shelves with the apartment for ice as specified, for the purpose of producing the circulation of air to equalize the temperature, substantially as described. And third, to the ice water reservoir in combination with the apartment for ice, as described."

5. For improvements in the *Drill, or Seed Planter;* Moses and Samuel Pennock, East Marlborough, Chester county, Pennsylvania, March 12.

The claims, as well as the description, under this patent, refer throughout to the drawings, and could not be understood without them. This difficulty patentees might obviate by furnishing suitable cuts, when the whole specification might be published.

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6. For an improvement in the process, or processes, of *Manufacturing Starch;* Orlando Jones, Middlesex county, England, March 12; to run 14 years from April 30, 1840, the date of the English Patent.

The patentee says—"My invention relates to a mode of treating, or operating on, farinaceous matters to obtain starch and other products, and for manufacturing starch, by means of submitting such farinaceous matters to a caustic alkaline process, as hereafter more particularly explained. I would, however, observe that I have not yet found that my invention can be applied with advantage in the manufacture of starch from potatoes."

Claim.—"What I claim as my invention is, first, the mode of treating, or operating on, farinaceous matters to obtain starch and other products, especially flour, or powder, produced from rice, and in the manufacture of starch by submitting farinaceous matters to a process, or processes, of caustic alkaline treatment, as herein described. And secondly, I claim the mode of manufacturing starch from rice by the process, or processes, described."

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7. For improvements in *Circular Saws, and the mode of driving them;* David Philips, Georgetown, Mercer county, Pennsylvania, March 12.

The carriage which carries the log is moved by a horizontal screw, and is provided with two racks, the teeth of which take into two pinions on the shaft of the circular saw, so that the motion of the carriage which feeds the log up to the saw at the same time actuates the saw itself.

The other parts will be fully understood by reference to the claim, which is in the following words, viz:—"I do not claim as my invention the mere attachment of a series of plates for the purpose of making a circular saw, nor making the teeth separate from the plates, as these have been done before, but not, as I verily believe, in the manner specified by me, and therefore what I claim as my invention and desire to secure by letters patent is, the method of attaching the plates, or arms, to the main flanch by letting them into recesses, of the form above described, in the flanch, and having the second flanch, or plate, rivetted, or bolted, to the main flanch, embracing the plates, or arms; they, the plates or arms, being provided with long slots through which the rivets, or bolts, pass, and a key passing through the flanch and plate, and through a notch in the end of the arms, for the purpose of regulating the sweep of the teeth in their revolution as described.

I also claim the guide attached to each plate, or arm, in front of each tooth, for the purpose and in the manner described; also the method of fastening the teeth to the arms by means of the dovetailed wedge cap, as above described. And finally, I claim the method of giving motion to the saw, or saws, by means of the combination of the screws, the rack, or racks, attached to the carriage, and the pinion, or pinions, attached to the saw shaft, so that the motion of the carriage, received from the screw, shall give motion to the saw, or saws, as described."

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8. For an improvement in the *Ploughing and Planting Machine;* Justus Rider, Woodburn, Waconssin county, Illinois, March 12.

The reader is referred, for an explanation of this implement, to the claim, which is in the following words, viz:—"What I claim as my invention, and desire to secure by letters patent, is the combination of a cultivator, or of ploughs for the preparing of the soil, to receive the seed, consisting of an opening share with two coverers behind it, with a seed drill having an opener in front with two coverers behind, the seed being deposited at the back of the opener—the arrangement of the share constituting the cultivator preceding those of the seed drill, as set forth."

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9. For improvements in the *Horizontal Wind Mill;* John M. Van Osdel, Chicago, Illinois, March 12.

We are under the necessity, in this instance, of omitting the claims, as they refer throughout to the drawings, and could not be understood without them. The mill is horizontal, and as the sails are carried around they turn on their axes so as to present their surface to the wind in the best position to receive the action of the wind to impel the mill. The general position of all the sails can be shifted as the wind changes, whilst the mill is in motion.

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10. For improvements in the mode of *Constructing and Propelling Steam Vessels;* William W. Hunter and Benjamin Harris, Norfolk, Virginia, March 12—antidated November 2, 1840.

The patentees say—"The nature of our invention consists in providing the vessel with an arch deck, called a shield deck, faced with iron, which facing forms, with the direction of any missive discharged from cannon afloat, an angle over 130°, and will therefore glance, or throw, off said missive. Said shield deck, in combination with the parts of the vessel below it, gives (by its displacement of water) a buoyancy, by which said vessel will float, though the vulnerable parts of said vessel be pierced, or torn by shot, so as to admit all the water capable of entering. The steam engines, machinery, and water wheels, are placed below said shield deck, and every part of them below the water line, therefore out of the reach of shot, and the water wheels being, from their position, always submerged, are relieved from the effect of the sea."

The wheels work horizontally or inclined, in cases, or trunks, built

in the vessel and open at the side. The wheels consist of a drum, with the paddles attached permanently to the periphery thereof. A portion of each wheel projects out of the case, or trunk, beyond the side of the vessel, and the shaft passes through the casing, and the water is prevented from leaking into the vessel by means of a stuffing box.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of shield decks to vessels constructed of metal, or wood, whether propelled by steam power or any other, and also the application of submerged water wheels, on the plan described in the accompanying specification, whether placed horizontally, or obliquely, for the purpose of propelling vessels."

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11. For an improvement in the manner of *Manufacturing Butt Hinges, by casting them in combined metallic moulds;* Thomas Shepherd and Thomas Loring, district of Southwark, Philadelphia county, Pennsylvania, March 16.

The patentees say—"We construct our moulds of iron, placing one mould upon another, so as to form tiers, one above the other; and in each mould, at each pouring, we cast a half hinge, the moulds containing, in the first pouring, a pattern which occupies one half thereof, and which is so constructed that it can readily be removed, leaving the half hinge first cast in the mould; and we then, by a second pouring, cast the second half of the hinges. Instead of a joint pin we usually cast the knuckles of one half the hinge with conical depressions, or countersinks, which are to receive conical projections on the knuckles of the other half; but, if preferred, joint wires may be inserted in the ordinary way, the respective halves being cast without conical projections."

"What we claim, and desire to secure by letters patent, is the manner in which we have constructed and combined the respective parts of our combined metallic mould for casting butt hinges, as above set forth; that is to say, we claim the constructing of metallic moulds, so as to arrange them in tiers, one above the other, on each side of a metallic gate; and so as that the said mould shall contain, at the time of the first casting, the pattern in the form of a half hinge, divided so as to deliver readily from the cast half, as herein described. We also claim the manner of combining these moulds so as that the lower side of the pieces shall constitute the half mould for each hinge in the series; and likewise the so forming and arranging them as to render them capable of being reversed for the purpose of casting the second half of the hinge; the whole being formed, constructed and operating substantially as herein fully made known."

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12. For an improvement in *Clamps for Crimping Leather;* Josiah M. Read, Boston, Massachusetts, March 16.

This patent is for a mode of securing the leather to that kind of clamp in which the leather is drawn by a screw that passes through

the clamp and bears against the heel of the crimping board, or form. One of the jaws of the clamp has a stud, which passes through the upper jaw, and then by means of a wedge passing through a slot, or under a shoulder in the stud, the upper jaw is forced upon the under, and thus bites the ends, or corners, of the leather placed between them.

The claim is confined to this device for clamping the leather.

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13. For an improvement in the *Harvesting Machine;* Alfred Churchill, Geneva, Kane county, Illinois, March 16.

This machine is intended for thrashing all kinds of grain when standing in the field, without cutting the straw.

There are two chains, one on each side of the forward part of the machine, which chains pass over rollers, or pulleys, and to which four rods are attached at equal distances apart. Immediately back of these chains and rods is placed the thrashing cylinder and concave, which are of the usual construction; and between the chains and rods, and the thrasher, there is a cap, provided with hooks, which slides up and down. As the machine is pushed forward the rods on the chains catch the heads of grain and push them towards the thrasher, at the same time one of the rods on the chains catches the hooks on the cap, which is thus lifted up, the heads of grain are pushed under, the cap is then relieved, falls on to the grain, and holds it during the operation of thrashing.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method herein described, of gathering and thrashing grain at the same time by means of the revolving rods, and oscillating or revolving cap, constituting the gatherer, in combination with the thrasher and concave, the whole being constructed and operating substantially in the manner set forth."

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14. For an improvement in *Gas Lamps;* Robert Cornelius, city of Philadelphia, Pennsylvania, March 18.

The patentee says that "the improvement consists in the manner of constructing the apparatus for conducting the gas from one of the burners of a hanging, or fixed, lamp, or of a girandole, by means of a descending tube, so as to cause it to issue from a burner at a convenient height for reading or for other purposes."

The end of the tube which is attached to the fixed burner fits into a cup of mercury attached to its base, for the purpose of preventing the gas from leaking out, and another burner is affixed to the lower end of this said tube at any desired height.

Claim.—"What I claim as constituting my improvement in the within described apparatus, is the manner in which I have formed the mercury cup within the body of a burner of brass, or of other metal, by lining the same with sheet iron, and having the jet affixed therein; and in combination therewith, the so constructing the upper end of the descending tube as to enable it to receive and contain the jet, and thus to obviate the necessity of its removal, when said de-

scending tube is to be used; the whole apparatus being constructed substantially in the manner set forth."

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15. For an improved *Machine for Boring the Conical Openings into the composition which constitutes the charge of War Rockets;* Alvin C. Goell, Washington, District of Columbia, March 18.

"It has been the practice heretofore," the patentee observes, "to bore the conical opening required in the composition of war rockets by means of a drill, or borer, running horizontally in a lathe, or other similar apparatus, a process by which the composition has not been freely delivered from the opening, and in the performance of which other difficulties have been encountered. In those cases, also, when it has been deemed necessary to remove the whole charge, the rockets have sometimes been put into water to dissolve out the composition, or it has been removed by other means which were inconvenient and wasteful."

The borer is attached to the upper end of a vertical shaft, to which part of the shaft there is attached a cup, or basin, to catch and retain the cuttings. The rocket is placed in a holder which slides up and down in the frame of the machine to present the rocket to the borer.

Claim.—"Having made known the manner in which I construct my machine for boring war rockets, and arrange and combine the respective parts thereof, I do declare that I do not claim to be the inventor of either of the parts thereof taken individually, nor do I claim the general arrangement of these parts, there having been machines made for other purposes bearing a considerable resemblance thereto; I therefore limit my claim to the particular manner in which I have adapted this instrument to the purpose of boring out war rockets and of collecting and preserving the composition with which the rocket was charged. That is to say, I claim the combining with the borer the cup, or basin, on the shaft, so as to bore out and collect the material from a rocket placed in a holder, or sliding frame, the whole being combined, connected, and operating as herein set forth."

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16. For improvements in the *Mortising Machine;* James King, Morristown, Morris county, New Jersey, March 18.

The shank of the chisel is cylindrical and fits into the end of a slide; and for the purpose of turning the face of the chisel in opposite directions, a pin, or handle, projects from the shank and plays in a notch cut out of the slide for that purpose. A helical spring is put on to the pin, or handle, which spring bears against its head and against the face of the slide, and consequently holds the chisel in its place whether turned with its face one way or the other.

The slide has rack teeth on it into which the teeth of two pinions work—there are rack teeth also on the inner face of the box in which the slide moves, into which one of these pinions gear; and on the shaft, or axle, of this pinion a handle is attached for the purpose of working the chisel; by this arrangement the chisel will be moved

double the distance, through which it would move if the pinion turned on its own axis. The other pinion above mentioned, has a spiral spring wound on its axis in the manner of a watch spring, which is coiled up by forcing down the spring, and which carries back the chisel when the handle is liberated.

Claim.—"What I claim, and desire to secure by letters patent, is the manner of applying and using the spiral spring on the handle for confining the handle in any desired position; and likewise the manner of applying a spiral spring for returning the slide and chisel, in combination with a mortising machine, such as is herein described, the whole operating substantially as set forth."

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17. For an improved apparatus for *Filing Saws;* Nelson J. Wemmer, Philadelphia, Pennsylvania, March 18.

A tube which receives the end of the saw file fits and turns in a block which is placed on, and secured to, a plate which is graduated with radial lines to indicate the inclination of the file. The graduated plate is placed on a table attached to the saw clamp.

The claim is to "the use of the block in combination with the tube passing through it, which tube receives the point of the file, as set forth. Also the combining with such a block, and its appurtenances, the graduated piece, in the manner and for the purpose set forth."

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18. For an improvement in the *Cross Cut Saw;* Henry Burger, Danville, Hendricks county, Indiana, March 18.

The saw is to be attached to, and strained in, a frame, or gate, and which is made to slide horizontally, by means of a crank and pitman, in the usual way. This horizontal frame is sustained upon a second frame which slides vertically, and is balanced by counter weights, suspended by cords passing over pulleys, which govern and regulate the feed.

Claim.—"All that I claim as my invention, and desire to secure by letters patent, is the vertical sliding frame, provided with cords, or ropes, and counter weights, in combination with the horizontal gate which slides in it, for the purpose and in the manner described."

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19. For an improvement in the *Lamp for Burning Camphine;* Michael B. Dyott, Philadelphia, Pennsylvania, March 18.

This patent is obtained for an improvement on, and has been added to, a patent granted on the 25th of August, 1840, and noticed in this Journal vol. ii, 3rd series, p. 263. By reference to the notice of the original patent the following claim will be fully understood, viz: "What I claim as constituting my invention is the constructing of the burner with its upper end closed, or forming a cap for the reception of the wick, without lateral openings, or joints, in the top, or cap, whilst it is at the same time capable of being removed or opened for inserting and adjusting the wick, the respective parts being formed as described."

20. For improvements in the *Machine for Making Pins;* John J. Howe, Derby, New Haven county, Connecticut, March 24.

The specification of this patent covers fifty-three folio pages, and is accompanied by numerous drawings, to which the claims refer throughout, and without which they could not be understood. A machine of this complex character does not admit of verbal description; we will merely observe that the wires are cut off, and received in carriers which are arranged radially around a wheel which successively carries them to cutters, revolving files, polishers, and other operating parts, until the pins are finished; the carriers receiving at each place the required rotary motion. The whole is arranged with much skill, and the manufacture is highly spoken of.

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21. For a *Square joint Dovetailing Machine;* William Perrin, Lowell, Massachusetts, March 24.

The nature of this "invention consists in arranging two circular cutters in such manner that they will cut the dovetails, and two other circular cutters to cut the pins to match, or fit, into the dovetails, and providing a carriage, with a slide and gauge to carry the boards to each pair of cutters."

"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the carriages one moving at right angles to the motion of the other, in combination with cutters arranged with their axles inclined, as described.

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22. For an improvement in the *Rotary Steam Engine;* Jesse Tuttle, Boston, Massachusetts, March 26.

In this engine, as in many of the old rotary engines, the chamber in which the piston works is formed by two plates, each having a semi-circular annular groove, which when put together form the chamber for the rotary piston to work in. The piston is attached to the outer edge of a plate which rotates on its axis between the two heads that form the piston chambers, commonly called the cylinder. On each side of this rotating plate is formed a cam groove, which receives a pin projecting from each side of a forked connecting rod, for the purpose of working the abutment valves. There are two of these abutment valves, placed on opposite sides of the piston chamber, with their forked connecting rods, the pins of which slide in slots made in the outer case of the engine. The steam chambers are situated on each side of the rotating plate, in which suitable appertures are made, as well as in the shaft, to conduct the steam from the side pipes to the piston. There is a sliding valve, with a handle, for changing the direction of the motion of the piston.

Claim.—"What I claim, and desire to have secured by letters patent, is the improvement of rotary engines by a combination not heretofore known; the said combination consists of the method of operating the abutment valves by means of the branched, or forked, connecting rods, having at each of their extremities a pin projecting at right angles

into the outer shell, or case, said pins working in a slot in the side of the case and operated upon by the cam upon the side of the rotating plate, as herein set forth. And the constructing of the steam chambers on each side of the rotating plate as described, connected with apertures in said rotating plate and shaft for conducting the steam to and from the piston, in combination with the side pipes and slide valves, the whole being combined, constructed and arranged as set forth."

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23. For an improvement in the mode of constructing *Fire Places and Chimney Stacks;* Henry R. Sawyer, city of New York, March 26.

The claim expresses the character of this improvement with much clearness, and we shall not, therefore, offer any further description of it.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of constructing a foundation for chimneys in buildings where no chimney stack has been constructed below, by turning the arch of the hearth at its inner end, on an iron, or other metal, shoe, secured to trimmer pieces on either side, said shoe being supported on a column, or pier, which column, or pier, rests upon the sill, course, or wall, below, or foundation wall of the building, the whole being constructed and operating as described."

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24. For improvements in the machine for *Excavating Ditches;* George W. Cherry, Washington, District of Columbia, March 26.

The ditch is to be excavated by means of cutters attached to the extremities of arms projecting from an inclined shaft, the arms being kept at their proper relative distances by an inclined wheel attached to them. Some of the arms are hinged so that they may be raised up when the machine is to be removed from one place to another, and this is consequently effected without the necessity of lifting the whole wheel. There are cams on the side of the inclined wheel which, as the cutter wheel revolves, strike against a lever, to communicate motion, by means of falls and ratchets, to the wheels on which the machine rests, and which consequently move it forward as the ditch is excavated. At the forward part of the machine there is a grooved wheel which runs on a rail for the purpose of guiding it.

Claim.—"What I claim as my invention and improvement, and which I wish to secure by letters patent, is, first, the manner of moving the machine forward by means of the cams attached to the arms of the inclined wheel acting on the arm attached to the vibrating axle, and by the arms and palls communicating motion to the ratchet wheels, as described; but it will be remembered that I do not claim the method of giving a forward motion to the machine simply by means of the ratchet wheels and palls, except as above limited. Second, the connexion of two or more arms to the inclined axle by means of hinges, so as to raise them from the ditch, as specified. Third, the method of guiding the machine by means of the grooved guide wheel, in combination with the movable rail track, as described."

25. For an improvement in the *Life Boat;* Joseph Francis, city of New York, March 26.

The claim is in the following words, viz: "What I claim as my invention, and wish to have secured by letters patent, is the application of air, or gas, chambers, or other agent, as a buoyant power below the line of the keel of boats and vessels, and also in the run and entrance, or end of the boat, below the keel, called sheet cylinders, in combination with the improvement in the model, forming double bottom or low bilges on each side of the keel, which I claim also separately for all boats and vessels with or without buoyant power, as set forth."

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26. For improvements in the *Rotary Steam Engine;* J. Jamieson Cardes, a citizen of the United States and now residing at Newport, England, and Edward Locke, of Newport, Monmouth county, England, March 29, 1841—patent to run 14 years from the 8th of July, 1840, the date of the English Patent.

The reader is referred to the claim which is in the following words, viz: "We, the said J. Jamieson Cardes and Edward Locke, do hereby declare that the new invention, whereof the exclusive use to be granted to us by the said letters patent, consists in the rotary engine herein before described, the distinguishing character of which is that a revolving wheel is enclosed within an exhausted box, or case, and impelled and turned rapidly round by a continual current of steam entering with force and velocity into the exhausted space wherein the wheel is situated and impinging against suitable vanes, at the circumference of such wheel, in the direction of a tangent to that circumference. The said box being connected by an eduction pipe, with a condenser which is kept cool by means of cold water, so as to exhaust the steam from the box, at that part of the circumference of the said box where the steam ceases to act against the vanes; and that condenser having an air pump capable of continual action in order to keep up the exhaustion within the common condenser."

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27. For an improved apparatus for *Regulating the Pressure of Steam and other Fluids, confined in pipes and other receptacles;* Francis R. Torbet, Paterson, Passaic county, New Jersey, March 29.

In the constructing of this apparatus one end of a balance lever is connected, by a joint link, with a sliding valve, which governs the inlet of steam, or other fluid, and the other end of said balance is connected with a piston which works in a cylinder opening into the pipe, or other receptacle, into which the steam, or other fluid, has been admitted. A sliding counter weight is attached to one end of the balance lever so that by moving it farther from, or nearer to, the fulcrum, the pressure of the steam, or other fluid, will be regulated. It will be evident that if the pressure within the pipe be too great, the piston will

be forced up in its cylinder, which, by means of the connexion with the balance lever, will partially close the sliding valve, and vice versa.

Claim.—"I do not claim as my invention any parts of the machine as new in mechanics, nor as involving a new or peculiar motion, but I do claim as my invention, and not previously known or used, the general arrangement of the machine herein described and set forth for the purpose of regulating the pressure of steam and other fluids confined in pipes and other receptacles, by means of a piston, moved by the pressure of the fluid itself, and communicating its motion to a slide valve so as to reduce the aperture through which such fluid, but under greater pressure, is admitted."

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28. For an improvement in machinery for *Manufacturing Lead and other Pipes;* Benjamin and Henry B. Tatham, Philadelphia, Pennsylvania, assignees of John and Charles Hanson, of Huddersfield, York county, England, March 29, 1841. Patent to run 14 years from the 13th of August, 1837, the date of the English Patent.

This patent is granted for certain improvements in that kind of machines in which pipes are formed by forcing the metal through an annular opening by means of a piston; but heretofore this has been done whilst the lead was in a fluid state.

Claim.—"First—The manner of making pipes or tubes of lead or other suitable metals by pressing or driving with great force the metal, while warm, though not fluid, but in a set or solid state through the apertures, arms, or divisions, of the holder or bridge," (which supports the core) "and so causing the metal to reunite around the core under the pressure after passing the bridge."

"Second—The plan of feeding the cylinder through the aperture in the upper end, or side, of the cylinder opposite the dies, and closing the aperture by the entry of the piston, in combination with the reversed arrangement of the cylinder and piston as particularly set forth, for the advantage of discharging the pipes downwards, and for the other important facilities and purposes described. Third—The conical form of the chamber between the bridge and the dies, by which the metal is constricted in its passage under the pressure. Fourth—The combination of the guide piece with the long movable core attached to the piston, in the manner and for the purpose described. Fifth—The adaptation of the improved parts by which several lengths of pipe may be made at one and the same time and operation. Lastly—The mode of constructing the piston by which the packing is forced outwards against the inside of the cylinder by the pressure of the face or end of the piston against said packing as described."

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29. For an improvement in *Propelling Boats and other Vessels;* William W. Van Loan, Catskill, Greene county, New York, March 29.

The patentee says—"In my improved mode of construction and arrangement, I so place the paddle, or propelling wheels, as that their

axes shall form an acute angle with a vertical line, say of from fifteen to thirty degrees, more or less; and their planes, of course, form a like angle with the horizon." "What I claim, therefore, as constituting my improvement, and desire to secure by letters patent, is the placing of the said wheels in the position herein made known, so that they shall enter and leave the water in a direction similar to that of oars in the ordinary process of rowing, the whole operating substantially in the manner described."

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30. For an improvement in the construction of *Wheels for Propelling Boats*, steam ships, and water and wind mills; John Hobday and William J. Cooke, Portsmouth, Virginia, March 29.

In this operation the paddle boards are to pass through openings in the periphery of a hollow drum, and are jointed to a crank within it. The crank remains stationary, but the drum is made to revolve on its axis, and in consequence of this the paddles will be projected beyond the periphery of the drum during one part of their circuit, and will be drawn in during the remainder.

Claim.—"What we claim as our invention and desire to secure by letters patent, is the introduction of a crank into a wheel, which, at the same time that it gives a new centre to the paddles, or arms, it enables them to protrude in time of action, and recede when not wanted for action, and at the same time makes the periphery of the wheel the forcing power on the arms, or paddles, and enables the constructer to make a wheel of the most powerful form."

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31. For an improvement in the machine for *Husking and Shelling Corn;* Samuel S. Allen, Miamisburg, Ohio, March 29. An improvement added to a patent granted on the 15th of January, 1840, and noticed in this Journal, vol. 1, 3rd series, page 199, to which the reader is referred.

Claim.—"What I claim as constituting my additional improvements in my machine for shelling corn, and which I desire to secure by letters patent, is the constructing my machine in such manner as that the convex posts of the frame are made to perform the office of the stationary pieces in the original machine; the movable staves, or curb pieces, being placed directly between the said posts, and these posts having the proper inclination for giving the proper form to the interior of the curb."

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32. For an improvement in the *Bee Hive;* William M. Hall, Wallingford, Connecticut, March 29. Improvement added to hive patent granted December 27, 1839, noticed in this Journal, vol. 1, 3rd series, page 107, to which the reader is referred for an explanation of the principle of the invention.

Claim.—"I do not claim as my invention the chamber with draw-

ers communicating with the hive below, nor sides adapted to cut off such communication, as they have been long known and used; but I do claim as my invention and new improvement, the direct communication between the drawers by means of corresponding orifices in each, as above specified, in combination with the right angled slides to close both orifices when a drawer is removed as above described."

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33. For an improvement in the *Counter Scales* for Druggists; Benjamin Morrison, Harrisburg, Pennsylvania, March 29.

This improvement is added to a patent granted February 16th, 1837, and noticed in this Journal, vol. xx, 2nd series, page 334, to which notice the reader is referred.

The improvement here patented constitues but a slight modification of the original scales as noticed above: and as the claims refer to the drawings, we shall omit them.

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34. For improvements in the machine for *Splitting Palm Leaf;* Carey McFarland, Barre, Worcester county, Massachusetts, March 31.

In this machine the palm leaf is split by means of grooved rollers and knives, and the waste and worthless pieces are separated from the good splints by means of two guides which carry them off. The good splints are discharged by the rollers into an inclined receiving board, and from thence into a sliding box which has a reciprocating motion that throws all the splints into a proper position for being made into bundles.

Claim.—"I do not claim as my invention the method above described of splitting palm leaf by means of the grooved rollers and knives, but what I do claim and desire to secure by letters patent is, the arrangement of the guides for separating the waste and worthless fragments of the leaf as described, and also the combination of the squaring box and receiving box for throwing all the pieces of palm leaf when split into proper position for bundling as described."

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35. For improvements in the machine for *Excavating Earth;* David C. Lockwood, New Windsor, Orange county, New York, March 31.

By means of a plough the earth to be excavated is thrown into partitions, made in an inclined wheel, and as the machine advances the earth is carried to the highest part of the inclined wheel and there discharged by lifting its inner edge which is attached to a lever. The machine runs on the lower edge of the inclined wheel, and on a small wheel, which runs within that portion of the rim of the inclined wheel which discharges the earth, so that a cart can run under this part of the inclined wheel to catch the earth discharged from it.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the within described mode of letting the dirt off from the wheel by lifting the stopboards which form the inner curb of the

periphery—and also the described arrangement by which the supporting wheel is brought within the inner edge of the upper part of the periphery of the inclined wheel, so as to allow a cart, &c., to receive the earth directly from the emptying stopboard."

Specifications of English Patents.

Specification of a patent granted to Thomas Spencer, *of Liverpool, for an Improvement, or Improvements, in the Manufacture of Picture and other Frames, and cornices; applicable also to other useful and decorative processes.* Enrolled September 8, 1841.

These improvements consist of particular applications of the new and important art to which Mr. Spencer originally gave birth, and are divided into ten heads.

The first comprehends a method of manufacturing picture frames in copper. For this purpose, a mould is made of the requisite pattern, from which a series of reverse, or intaglio, moulds are cast, in the usual manner. The cast, if not a conductor of electricity, is made one, and copper deposited upon it by the galvano-plastic process. When a sufficient thickness of copper is deposited, it is removed from the mould, and its back filled up flush with solder, and a metal rebate placed round the inside, to receive the glass or picture. The frame is then ready for gilding.

Secondly, we have a similar method of producing moulds, by the galvano-plastic process, in which composition, or papier machée, ornaments may be cast; such moulds being also applicable to glass, earthenware, and china. An exact model of the ornament or other article being produced, it is attached to a perfectly flat surface, and both being made conductors, copper is precipitated thereon by the galvanic process. The copper mould thus obtained is tinned at the back, and filled up flush with metal, in order to give it the required strength.

Thirdly, the patentee describes a mode of manufacturing obverse moulds in copper for casting therefrom ornaments, &c., in iron. Any desired pattern is rendered a conductor of electricity, and coated with copper by galvanism. In order to obtain a smooth surface at the back of the deposited copper, the cast on which the deposit is to be formed is placed horizontally in the vessel containing the cupreous solution, with its face downwards, and the copper surface which supplies the copper is placed upon the bottom of the vessel. The mould thus deposited may be used as an obverse mould for making patterns in sand for iron castings.

Fourthly, a mode of covering the surfaces of metallic picture or other frames with gold; the same process being likewise applicable to other surfaces, and to the rising or embossing of devices in gold or its alloys. For this purpose, a solution is prepared of pure gold, or of its alloys, in bromine or iodine, and to this mixture a few drops of sulphuric acid are added. The surface to be coated is cleaned in the

usual manner, and then immersed in the solution, being connected with the positive wire of a galvanic battery; a surface of gold to be eroded is connected with the negative wire, and the battery put in action, when a deposition of gold is effected of any desired thickness.

Fifthly, a mode of employing silver for covering surfaces. The solution is prepared as follows: silver is dissolved in bromine and alcohol, by means of galvanism, and this solution is allowed to precipitate a yellowish white powder; the liquid is then decanted, and the precipitate is boiled for ten minutes in thirty times its weight of a saturated solution of acetate of ammonia. Or a solution may be formed by dissolving an iodine of silver in prussiate of potassa, or any of the ammoniacal salts.

Sixthly, how metallic surfaces may be covered with platinum. For this purpose a quantity of platino-bichloride of ammonia is mixed with sixty times its weight of water, to which three parts of muriatic acid have previously been added; this mixture, after being boiled for about ten minutes, forms a solution, which is to be used in lieu of the usual solution of copper. Or bromine mixed with its bulk of alcohol is added to spongy platinum, and stirred or shaken till dissolved; this solution is then combined with half its bulk of dilute sulphuric acid, containing six times its weight of water, when it is ready for use.

If leaden surfaces are to be coated with platinum, they are cleaned by the usual method, and immersed for six hours in water containing half an ounce of either of the solutions of platinum to half a gallon of water; on its removal it will be found to have changed to a dark brown colour. If a more permanent coating be required, the lead is connected with a voltaic battery while in the solution, which should then be of double the strength. Lead so coated is applicable to surfaces used for the negative plates of galvanic batteries.

Seventhly, there is described a method of covering metallic surfaces with tin, applicable to the purposes mentioned under the fourth head. The metallic surface being thoroughly cleaned, is then placed with a surface of tin in a solution of acetate, or of muriate of ammonia, or sulphate of soda, and connected with a galvanic battery, by the action of which, tin is deposited of any thickness.

Eighthly, a mode of cleaning surfaces of iron, and then covering them with copper, by means of voltaic electricity. The iron to be cleaned is attached by a wire to the platinum end of a voltaic battery, consisting of three pairs of plates, each plate having the same quantity of surface as the iron to be operated upon; another surface of iron is attached to the zinc end of the battery, and the two surfaces immersed in a saturated solution of sulphate of soda. In a few minutes the surface will be ready to be deposited upon, when it is attached to the zinc end of a battery of three pairs of plates, and a piece of copper is connected with the platinum end of the battery; the copper and iron being immersed in a solution of copper, copper is deposited on the iron surface.

Ninthly, a method of producing enriched surfaces, applicable to picture frames, cornices, and other decorative purposes, by the use of embossed calico, paper, or other similar fabrics. The pattern being

embossed on the fabric by dies or rollers, is cut out and cemented on to the surfaces to be enriched, a coating of thick whiting being first applied to the hollow side to fill up the spaces, and give it the required strength.

Tenthly, a method of improving the texture of the composition used for casting ornaments for picture frames, cornices, and decorations, by adding to the materials usually employed for this purpose, caoutchouc dissolved in spirits of turpentine, asphalte, pyroligneous spirit, or spirit of tar, in the proportion of one pound of the caoutchouc to every six pounds of glue, used in making the composition.

The claim is, 1. To the application of voltaic electricity to the manufacture of picture and other frames.

2. To the application of voltaic electricity to the manufacture of moulds for the purposes mentioned.

3. To the application of voltaic electricity for the purpose of making patterns, or moulds, for iron founders, in copper.

4. To the use of bromine and iodine combined with gold, in conjunction with voltaic electricity, for the purposes before mentioned.

5. To the use of bromine and iodine combined with silver, in conjunction with voltaic electricity, and applicable to the surfaces mentioned under the fourth head.

6. To the use of the solution of platinum, in conjunction with voltaic electricity.

7. To the use of bromine combined with platinum, and in conjunction with voltaic electricity.

8. To the covering of lead with platinum, and applying it for the first time to the use above mentioned.

9. To the covering of the surfaces mentioned under the fourth head with tin, by the particular methods described.

10. To the method of cleaning iron surfaces, and the regulation of the quantity and intensity of electric force necessary to render iron fit to be deposited on, for the first time pointed out.

11. To the method of producing embossed or enriched surfaces on picture and other frames, and cornices, being also applicable to other interior decorations.

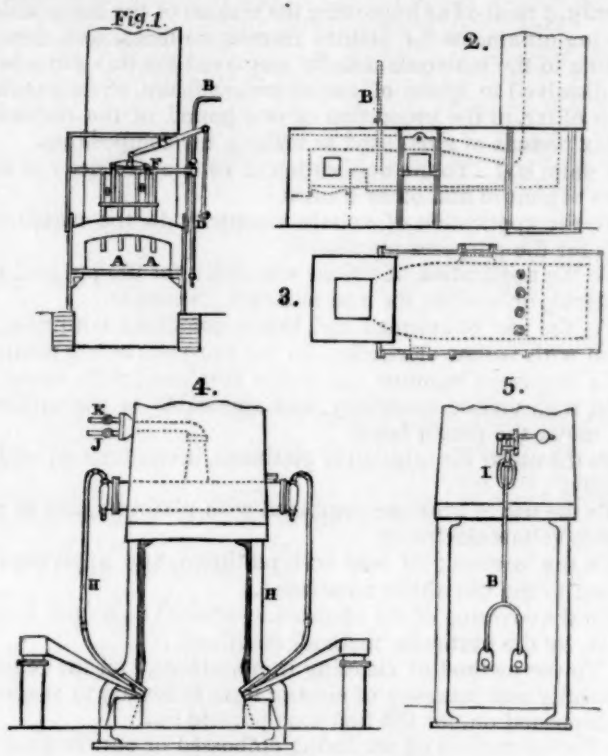
12. To the application of caoutchouc for the purposes before mentioned.

Mech. Mag., Oct., 1841.

Specification of a patent granted to Josiah John Guest, *of the Dowlais Iron Works, Glamorgan, and* Thomas Evans, *of the same place, for certain improvements in the Manufacture of Iron and other metals.*

The nature of this invention consists in forcing damp steam into the melted mass of metal, whatever it may be, contained in the melting furnace used for melting the said metal in, and particularly into the melted iron in refining and puddling furnaces, as also in a certain paste made with the said steam and melted cinders, and applied as hereinafter explained; and the following is a description of the man-

ner in which the said invention is to be performed, with reference to iron, reference being had to the drawings, and to the figures and letters marked thereon:–



Description of the Drawings.

Fig. 1 represents the front elevation of a puddling furnace. A jet, or jets, of steam is, or are, introduced into this furnace, in contact with the melted iron, while in a state of what is usually called fermentation; the steam is conducted through the roof of the furnace, as here shown, through wrought iron telescope tubes, sliding one over the other, by means of which tubes we are enabled to convey the steam very near to the surface of the fluid iron to be acted upon; the success of the operation depends much on bringing the steam in close contact with the melted iron; therefore, any other plan of introducing the steam close to the iron may be found to answer the same purpose—the steam that we have used for our experiments has been supplied from the ordinary engine boiler; but, as shown in the case of the refinery furnace, fig. 4, we purpose generating the steam in the chimney of the furnace; the pressure we have used in the puddling furnace has been about fifteen pounds to the inch, through four pipes, A, A,

three-quarters of an inch in diameter, which answers very well during this process, in order to keep the sides, bridge, and bottom of the furnaces from burning. We introduce a quantity of steam upon the fluid cinders as soon as the heat is drawn until the cinders become of the consistency of paste; we then, with a rabble or rake, rake as much of that paste, and place it against the back, sides, and bridge of the furnace, as may be required, to fill any cavity that may have been burned during the previous heat of iron; the use of cinders in a state of paste for repairing the bottom and sides of the furnace keeps the iron quite clean and free from dirt, which is always found from the use of clay and limestone, as at present used. The tubes, A, A, which pass through the roof of the furnace, slide over the tubes B, B, forming thus telescope tubes, and they are raised or lowered according to the quantity of fluid metal in the furnace, by means of the lever, C, and handle, D, by which it is worked; the dotted line shows the height of the fluid metal. E is the steam pipe; F the connecting pipe, for communicating alike to all the four telescope tubes; and G is a condensed water pipe.

Fig. 2 is a side elevation.

Fig. 3 a plan of the puddling furnace.

And now, as to the refinery furnace; we introduce a jet, or jets, of damp steam, after the pig iron is melted, through the same aperture as the blast; the quantity and temperature of the steam must depend upon the quality of the pigs to be acted upon; we use four pipes of half an inch in diameter, with a pressure of twenty pounds to the inch, and find it answers our purpose; the steam is by us generated in the chimney of the refinery furnace, but it may be conveyed from the engine boilers.

Fig. 4 represents a side elevation of our steam apparatus, shown in two of the four tuyeres or apertures of a refinery furnace.

Fig. 5 is another view of it. In fig. 4, H H, are two of the steam pipes, the steam being generated in the tube, or cylinder, I, in the flue or chimney, which cylinder, I, is filled with water—J being a water feed pipe, and K a pipe on which to place a safety valve.

Now, whereas we propose to apply steam in a similar way in the melting of alloys of copper and iron, and of tin and iron, which alloys can be made in refinery and puddling furnaces by it; but in particular we apply our said invention to the manufacture of iron, whereby we obtain a better material with greater economy. And we claim as our invention the use, or application, of steam forced upon, or into, or in contact with, the melted iron, in refinery or puddling furnaces for the manufacturing of the same. And also the similar use of steam in the process of melting or manufacturing alloys of copper and iron, and of tin and iron, in such furnaces; and also the application of steam to fluid cinders, as hereinbefore described, to produce the paste aforesaid, and the use or application of the said paste, as aforesaid.—*Repertory of Patent Inventions.*

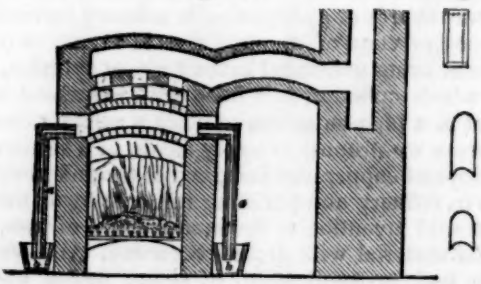
Mining Jour., Nov. 1841.

Specification of a patent granted to* WILLIAM JEFFERIES, *of Holme street, Mile end, for improvements in obtaining Copper, Spelter, and other metals, from ores.

This invention relates, first, to a mode of obtaining copper from copper ore; and, secondly, to a method of obtaining zinc from zinc ores.

The patentee says, his improvements are confined to the smelting process, and prefers the ores to be in a raw state, instead of calcining or roasting previous to smelting; the ores may, however, be roasted or calcined previous to smelting. If this invention is to be applied to a smelting furnace, worked according to the old plan, the furnace is charged with raw or calcined ore; and when it has been well skimmed, a quantity of carbon or alkali, ground to a fine powder, is stirred into the melted mass, friable, in which state it is pushed forward to the bridge, and the heat continued until the mass is well melted; the furnace is then tapped, and the metal run off into water, leaving the slag in the furnace; then charge the furnace again, and treat the charge with carbon or alkali, as above described. It is not necessary, however, to tap or draw off the metal after each charge, as two or three charges may be added, and treated with alkali or carbon, previous to tapping. The carbon preferred by the patentee is anthracite coal or charcoal, and when alkali is used, he prefers common soda, but does not confine himself to it alone. The metal obtained by this process must subsequently be treated in the same manner as metal obtained in the ordinary way; and, as this after process is well known, it will not be necessary to give any further description.

Fig. 1. *Fig.* 2.



The second part of the invention relates to a method of smelting fine ores, and consists in carrying on the smelting process in large ovens, heated externally, by which means a large quantity of ore may be operated upon at once, at a very reduced cost, and zinc produced of most excellent quality. The description of oven and furnace employed by the patentee, is shown at fig. 1, which represents a transverse section of an apparatus, suitable for treating three or four tons of ore at the same time, instead of having a number of small vessels or retorts in a furnace. From the upper as well as the lower parts of

such oven, several small pipes, *a a*, descend into vessels, *b b*, containing water; and, as distillation proceeds, the metallic zinc will (as it becomes evaporated) pass down the pipes, *a a*, and be cooled. In constructing an oven for this purpose, the bottom and roof should be as thin as possible, so as to allow the heat to pass freely through the fire-brick, and at the same time the bottom must be strong enough to support the charge of ore. The fire-bricks, of which the oven is composed, are therefore of a peculiar form, as shown at fig. 2; and, by this means, the bottom of the oven may be made of three inch bricks, and the arch, or top, of two inch bricks.

In working, according to the improved mode, we will suppose that the oven has been at work, and is ready for a new charge; the ore is taken and mixed with about five per cent. of small bituminous coal; the oven is then charged as full as possible, and the mouth closed and luted with fire-clay; continue the fire, and distillation will proceed, as when small vessels or retorts are used, the metal passing down the pipes into the receivers as it is distilled. As there are several pipes to conduct off the distilled metal, care should be taken that none of these pipes are left open to admit atmospheric air. When the charge is worked off, the oven is opened, and the refuse or slag drawn out, and a fresh charge immediately supplied.

In conclusion, the patentee says, that although he has been particular in describing the exact means he pursues, yet he does not mean to confine himself thereto, so long as the general character of the different parts of the invention are retained. And he claims, as the first part of the invention, "the mode of smelting copper ores, by treating the melted metal with carbon or alkali, as above described; and, secondly, the mode of obtaining zinc from ores, by means of ovens, as above described."

Ibid.

Specification of a Patent granted to Hugh Lee Pattinson, *of Durham, for improvements in the Manufacture of White Lead.* Enrolled September 10th, 1840.

This invention consists in the application of carbonate of lime to certain salts of lead, so as to produce a decomposition of the said salts of lead, and a reciprocal exchange of acids and bases between the carbonate of lime and the salt of lead employed. By this chemical re-action, carbonate of lead, or white lead, and a solution of lime, are obtained;—the composition of the latter depends upon the particular salt of lead made use of in the process.

The salts of lead employed, are the chloride and the nitrate; and in order to make the invention more perfectly understood, the patentee has detailed the chemical phenomena which take place when carbonate of lime and chloride of lead re-act upon each other; but, as our space is rather limited, we must pass on to a description of the practical means required to manufacture white lead, according to the improved process.

The patentee uses a mill of the following construction, to triturate

the materials of which the white lead is composed. It consists of a strong wooden tub, secured with iron hoops, the bottom of which is formed of blocks of hard stone, firmly cemented together, so as to present a level surface. Other larger blocks, of the same kind of stone, are carried round upon this bed, by machinery, so that any hard and brittle substances, when placed in the tub with water, are continually rubbed under it, until reduced to the finest powder.

This description of mill is employed, because it continually mixes, and rubs together, the materials submitted to its action. Care should be taken that no iron, employed in the construction of the mill, may be so situated as to be liable to act upon the bodies to be ground; and where metallic fastenings are required, copper may be used. Into a mill of this kind, twelve feet in diameter, and three feet deep, put twenty-one hundred weight of chloride of lead, and seven and a half hundred weight of carbonate of lime, in the form of the best washed chalk or whiting; then partly fill the tub with water, and put the mill in motion. After the materials have been ground from four to six hours, cease grinding, and add more water, until the tub is nearly full; then suffer the whole to stand till the next morning, when a white mass, consisting of carbonate of lead, mixed with undecomposed carbonate of lime and chloride of lead, will be found at the bottom of the tub, and above this, a clear liquor, which is a strong solution of chloride of calcium, nearly free from lead. This solution must be drawn off, by means of a syphon or plug, and as much fresh water added as the tub will conveniently hold; then the grinding is renewed for a few hours; and when stopped, the materials are allowed to settle as before, and the solution again drawn off, and fresh water added, the grinding being continued again for a few more hours. The process is continued, day after day, in this manner, the supernatant liquor becoming every day a weaker solution of calcium, nearly free from lead, until at the end of seven or fourteen days it is nearly tasteless, when the decomposition is considered to be complete, and the white mass, at the bottom of the tub, will have become very nearly a pure carbonate of lead; in which state it is removed from the tub, and dried and prepared for the market in the usual manner.

When the patentee uses water, impregnated with carbonic acid gas, instead of grinding the materials together, as above described, he employs the following apparatus:—

A barrel, made of lead, wood, or copper, strongly hooped with iron, and of any convenient size, is mounted on gudgeons; to one of which, a fast and a loose pulley are connected, and rotary motion is communicated thereto from machinery, by means of a band. The other gudgeon is made hollow, and communicates with the interior of the barrel; it is also furnished with a stop-cock, and, by means of a screw-joint, may be connected to a force-pump, for the purpose of forcing carbonic acid gas into the barrel.

One hundred and forty pounds of chloride of lead, and fifty pounds of carbonate of lime, are introduced into the barrel, through an aperture made in the end thereof; then the barrel is nearly filled with pure water, and the aperture is closed by means of a screw-plate and

leather washer. Carbonic acid gas is then forced into the barrel, by means of the force-pump, until the water is saturated under a pressure of four or five atmospheres; after which, the barrel is made to revolve at the rate of twenty revolutions per minute, and the substances within immediately begin to act upon each other; the carbonic acid solution dissolving the carbonate of lime, and presenting it to the chloride of lead in a better form for decomposition than when solid, or nearly so. This operation is carried on for three or four days; at the expiration of which, the action has advanced so far, that very little chloride of lead, or carbonate of lime remains, and the liquid is a strong solution of chloride of calcium, which, when the insoluble mass is settled, may be removed from the barrel in any convenient manner, and a further quantity of water, impregnated with carbonic acid, must be added, and the barrel set in motion for a day or two longer, until the decomposition is perfected.

When nitrate of lead is used the same process is adopted with the chloride, except that the exact chemical equivalent of the two substances is employed. In the grinding tub, twenty-four hundred weight and nine-tenths of nitrate of lead, and seven and a half hundred weight of carbonate of lime, are ground together; and in the barrel, one hundred and sixty-six pounds of nitrate of lead, and fifty pounds of carbonate of lime are introduced. In both cases, the two substances are allowed to re-act upon each other, until the decomposition is complete; after which the carbonate of lead is removed, and prepared for sale.

Lond. Jour. Arts & Sci.

Specification of a patent granted to John Henry Le Keux, *of Pentonville, for an Improvement in Line Engraving, and in producing impressions therefrom.*

This improvement consists in engraving a subject on two plates, one portion of the subject on one plate, and the remainder on the other, so that when printed, the combination of the two impressions shall produce the effect required.

Two plates being prepared for engraving, on one of them is put a tracing of any given subject. The outline and dark shadows are then etched on this plate, and finished by the usual process of line engraving; this plate is called the subject plate.

A tracing, or transfer, from the above is then placed on the other plate, and a tint of lines is ruled all over the subject; the lights are then stopped out, and the under tints, or shadows, are produced by biting in; thus forming what is called the ground plate. The plates being marked with register lines are printed, one upon the impression of the other, so as to produce the effect sought.

The claim is to the ruling of a tint of lines, and then producing the required under tints, lights, or deep shadows, on a separate plate from that on which the general subject is engraved, and then taking impressions from the two plates so engraved in the manner described (both being engraved in the style called line engraving,) whereby an entirely novel effect is produced, with a considerable saving of labour.

Mech. Mag. Sept., 1841.

Specification of a patent granted to RICHARD LAWRENCE STURTEVANT, ***of Bethnal Green, for Improvements in the Manufacture of Soap.*** Enrolled September 8, 1841.

These improvements consist in manufacturing hard soap at one operation in the ordinary boilers, without separation of lees, or precipitation of niger, which is effected by using some, or all, of the following ingredients, viz., cocoa-nut oil, palm oil, tallow oil, and potash lees. Also the muriates of soda and potash.

The specific gravity of the lees is measured by Beaumé's hydrometer, at a temperature of 62° Fahr.

The following is the mode of making white soap: 2,072 lbs. of cocoa-nut oil, (in its raw state, or deprived of its rancidity in the manner hereafter noticed;) 168 lbs of olive oil, sweet oil, or tallow; 375 gals. of soda lees at 24°, and 60 gals. of potash lees at 20°, are boiled together in the following order:—The cocoa-nut, and other, oil, or tallow, are first put into the copper, which may be heated by fire or steam; 10 gals. of the soda lees are then added, and the mixture allowed to boil; the remainder of the soda lees is added from time to time in similar quantities, the mixture being kept boiling. In about ten minutes after the whole of the soda lees have been put into the copper, about 84 lbs. of muriate of soda, or potash, are slowly sprinkled over its surface, and the mixture boiled for half an hour, when the fire or steam is withdrawn, and the soap is finished, and is to be cleansed or framed, when cool, in the usual way.

A hard soap for fulling, and such like purposes, is composed of the following ingredients, viz., 1,792 lbs. of cocoa-nut oil; 336 lbs. of tallow; 224 lbs. olive oil; 112 lbs. of rape oil, or of colourless palm oil; 400 gals. of soda lees at 25°, and 80 gals. of potash lees at 20°.

All these ingredients being put into the copper, the heat is applied, and the operation conducted as above, except that the muriates of soda or potash are not used, but as soon as the soap is made, 2,240 lbs. of grained, or curd soap, made upon the old plan, is added, and the mixture boiled until the two soaps are thoroughly incorporated.

To remove the rancidity of cocoa-nut oil, 10 cwt. of it is boiled in a wooden vessel by steam, with three pounds of sulphuric acid, or six pounds of muriatic acid. Or the oil is boiled alone for a sufficient length of time in an iron pan, by means of a dry heat.

The claim is, 1. To the making of hard soap, at a single operation, without separation or removal of lees, or precipitation of niger.

2. To the use of cocoa-nut oil, in conjunction with other materials, in the manner, and for the purpose, described.

To the mode of depriving cocoa-nut oil of its rancid and unpleasant odour by the processes described.

4. To the use of potash lees for the purpose of improving the quality and appearance, and giving a greater tenacity to soap.

5. To the use of muriate of soda, and muriate of potash, for the purpose of giving greater tenacity and hardness to soap.

6. To the ascertainment with greater falicity and accuracy of the

quantities and proportions of alkaline lees requisite to be used with the other ingredients in the manufacture of soap.

7. To the mode of making a fulling soap, or soap for manufacturing purposes, in the manner described. Ibid.

Specification of a patent granted to JOSEPH MAUDSLEY, *of Lambeth, for an Improvement in the Arrangement and Combination of certain parts of Steam Engines, to be used for Steam Navigation.* Enrolled September 16, 1841.

This improvement consists of an arrangement of marine steam engines. The steam cylinder has a small open topped cylinder placed concentrically within it; the piston is a broad rim, or annulus, which fits the space between the interior of the large, and exterior of the small cylinder. The piston is jointed to the lower end of the connecting rod in the following manner; two vertical piston rods rise from opposite sides of the piston, and passing up through stuffing boxes in the cover, are united to a T-shaped cross-head; the upright stems of this cross-head descend into the small cylinder, and the lower ends are attached to a guide block, to which the connecting rod is also attached by a joint pin; which pin, according to the length of the upright stems of the cross-head, may be placed either above or below the piston, or level with it. The cross-head is composed of two parallel plates, united at the extremities of the horizontal arms, a sufficient opening being left between them for the working of the connecting rod.

The claim is to the improvement in the arrangement and combination of the different parts of steam engines to be used for steam navigation. The distinguishing character of that improvement being, that the connecting rod, with its appurtenances, is situated, and works, within a small open topped cylinder, which is fixed in the central part of the steam cylinder, and within the central part of the annular piston. Ibid.

Specification of a patent granted to JOHN DEANE, *of Dover, for Improvements in Preparing Skins, and other animal substances, for obtaining gelatine, size, and glue, and in preparing skins for tanning.* Enrolled August 23, 1841.

The hair is first removed from the skins, by placing them in a solution of lime, potass, or soda, in the proportion of from 8 to 26 lbs. of lime, and from 4 to 16 lbs. of potass or soda to every fifty gallons of water. The skins are then placed in a revolving cylinder formed of bars of wood or metal, or a perforated surface of wood may be used, and the cylinder being placed in a trough filled with any of the before mentioned solutions is caused to revolve until the action of the lime, &c., aided by friction, has removed all the hair. The skins are then taken out of the cylinder, fleshed or shaved, and washed until thoroughly cleansed. They are then steeped in a large vat of water,

until a slight putrescence is apparent, when they are removed to suitable vessels, and covered with water, into which is poured from 6 to 28 or 30 lbs. of hydrochloric acid from each cwt. of animal substance. The vessel is then covered over, and the skins left to the action of the acidulated water from eight to twenty-four hours, or until the skins assume a white semi-transparent appearance, when they are taken out and thoroughly washed in cold water, and afterwards deposited for two or three days in a tank, through which a current of fresh water flows continually. Instead of the hydrochloric acid in solution, the skins may be treated with hydrochloric acid gas. Hides, &c., are subjected to the above processes, and then tanned in the ordinary way.

The claim is to the use of a rotating, perforated, or other, cylinder, for the purpose of unhairing the skins, hides, or pieces, to be used in the manufacture of gelatine, size, or glue; when used in combination with a solution of lime, potass, or soda, or combined portions of either. Also, the application of hydrochloric acid, or hydrochloric acid gas, or either of them diffused in water, in whatever manner they may be employed; when applied to hides, skins, or other animal substances, for the purpose of preparing them for the manufacture of gelatine, size, or glue. Also the sole application of the above mentioned acid and acid gas to hides and skins, for the purpose of preparing them for being tanned.

Ibid.

METEOROLOGICAL OBSERVATIONS FOR MARCH, 1842.

Moon.	Days.	Therm. Sun Rise.	Therm. 2 P.M.	Barom'r. Sun Rise.	Barom'r. 2 P.M.	Wind. Direction.	Wind. Force.	Water Fallen in rain	State of the Weather, and Remarks.	
	1	40°	58°	30.00	30.00	SE. SW.	Moderate		Cloudy.	Flying clouds.
	2	38	59	29.70	29.50	SE. SW.	do	.08	Drizzle.	Drizzle.
☽	3	50	71	29.73	29.73	W.	do		Clear.	Clear.
	4	54	63	29.73	29.70	SW NW.	do	.15	Par. Cloudy.	Thunder shower.
	5	59	66	29.55	29.70	W.	Brisk		Clear.	Flying clouds.
	6	43	46	30.00	30.00	E.	Moderate		Cloudy.	Cloudy.
	7	42	42	29.86	29.86	W. NW.	do	.31	Cloudy.	Rain.
	8	31	44	30.26	30.30	SW.	do		Clear.	Clear.
	9	40	41	30.10	29.84	SW.	do	.24	Cloudy.	Rain.
	10	57	67	29.84	29.84	SW.	do	.12	Cloudy.	Cloudy, rain.
	11	41	52	29.60	29.60	NE. NW.	do		Cloudy.	Partially cloudy.
⊗	12	23	32	30.25	30.36	NW.	do	.02	Clear.	Clear, snow in night
	13	32	45	30.16	30.10	SE. W.	do		Cloudy.	Cloudy.
	14	36	49	30.10	30.10	W. SE.	do		Cloudy.	Cloudy.
	15	34	49	30.06	30.06	W.	do	.08	Clear.	Cl'dy, thunder sh'r.
	16	32	50	30.25	30.25	SW.	do		Clear.	Partially cloudy.
	17	40	60	29.95	29.84	SW.	do		Cloudy.	Cloudy.
	18	44	62	30.00	30.10	NW.	do	.37	Clear.	Lightly cl'dy, th.sh'r
☾	19	40	66	30.00	29.90	SE. W.	do		Par. Cloudy.	Hazy.
	20	55	67	29.90	29.85	SW.	do	.14	Cloudy.	Lightly cl'dy, th.sh'r
	21	38	37	30.00	30.05	NE.	do		Par. cloudy.	Cloudy.
	22	34	39	29.85	29.85	NE.	do		Rain.	Cloudy.
	23	33	44	30.10	30.13	E.	do		Cloudy.	Cloudy.
	24	35	45	30.16	30.16	SE.	do		Cloudy.	Cloudy.
	25	40	42	29.80	29.70	E.	do	.55	Rain.	Cloudy.
⊕	26	40	47	29.70	29.80	W.	Brisk.		Cloudy.	Flying Clouds.
	27	33	58	30.10	30.04	W.	do		Clear.	Clear.
	28	41	48	29.85	29.95	NW.	Blust'ring		Clear.	Flying clouds.
	29	31	52	30.24	30.24	W.	Moderate		Clear.	Clear.
	30	42	68	29.60	29.60	SW.	do		Par. cloudy.	Cloudy.
	31	45	50	29.90	29.90	NW.	Brisk.		Clear.	Flying clouds.
		40.13	52.23	29.93	29.94			1.96		

Thermometer.		Barometer.	
Maximum 71.00 on 3rd.	Mean, 46.18.	Max. 30.36 on 12th.	Mean 29.935.
Minimum 23.00 on 12th.		Min. 29.50 on 2nd.	